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ELECTRICAL REVIEW

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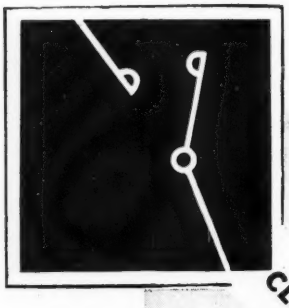

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ELECTRICAL REVIEW

Volume CXXX — No. 3369

Friday, June 19, 1942

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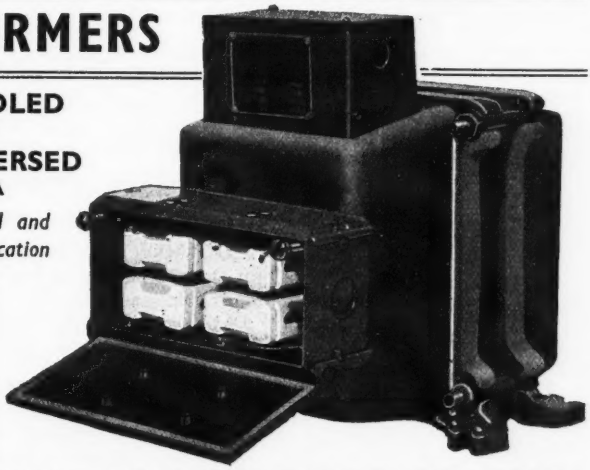

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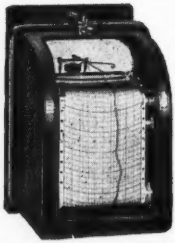

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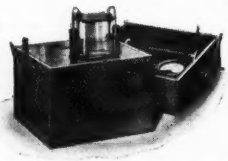

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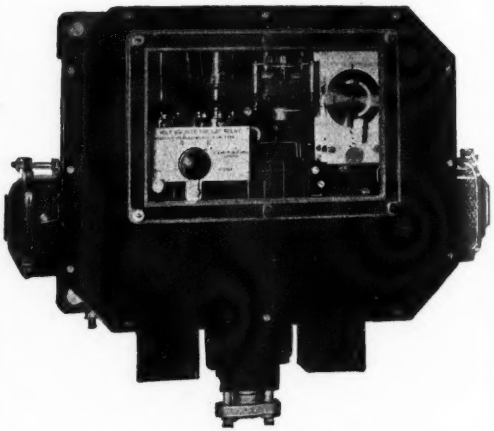

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ELECTRICAL REVIEW
THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXX. No. 3369. JUNE 19, 1942 6d. WEEKLY

Healthy Competition

A Necessary Stimulus

FROM time to time when the relationship of public utilities is under discussion one hears the glib and almost question-begging expression "wasteful competition." Often it has been used to justify the control by a common committee of municipally owned electricity and gas undertakings, an arrangement that can hardly be said to have been in the ultimate interests of either. In this respect it may be partly a relic of those early days when relief was sought from the statutory obligation to supply gas in areas where, it was feared, the coming of "the" electric light would make it unremunerative to do so.

Cheapness and Convenience

The intervening sixty years have shown this defeatist attitude to have been unwarranted. Our gas competitor was virile enough to find other outlets for its products and we of the electrical faith have done likewise. This rivalry has been a most important factor in fostering technical developments which have reduced capital costs (whether for works and distribution plant and mains or for consuming appliances) incurred per ton of coal turned into cleaner and more convenient forms of energy, thus going far towards offsetting any possible redundancy in expenditure, even if frequent extensions and reinforcements had not been necessary to meet growing demands.

Similar considerations prevail in regard to improvements in efficiency in operation, which have led to greater demands and hence to more coal being gainfully used, much of it for purposes not formerly envisaged. The growth year by year in the tonnage used for generating electricity has been accompanied by no diminution in that required for gas making, while the consumption of raw coal for other purposes has remained practically unaffected. For certain applications it seems at least possible that the number of BThU supplied to the public by either industry would actually have been less if the other had not existed. This increased consumption of coal has taken place despite the considerable production economies that have been achieved, but the latter should not be unduly stressed, since high thermal efficiency is not an end in itself but only a means of promoting social well-being.

Not Uneconomic

The beneficial interplay of technical progress and growing output comes to life through the stimulus provided by the competition of the two industries. Suspicion that such competition is of the "cut-throat" variety seems inconsistent with the not unsatisfactory financial position of utility undertakings. Uninformed criticism based on the assumption that services charged for at a rate lower than the average cost of supply must be provided at a loss can be answered by showing that, whereas 6d. per kWh in some cases is quite unremunerative, a charge of, say, ½d. can in others provide a satisfactory profit. Moreover, it is not a question of selling a commodity the demand for which is fixed, but with a service that is capable of

being expanded to as yet unmeasured limits.

Nevertheless, there are many fields in which the collaboration of the two industries can be fruitful. Through such organisations as the Conjoint Conference of Public Utility Associations, the Institute of Fuel and the Illuminating Engineering Society they have agreed on common policies and on technical details of concern to both, and more could be done on the same lines. It is, however, to the rivalry of the two industries in earning the favour of the public that progress has been mainly due and this must be remembered when both are able to resume their full activities.

The Birthday Honours

HAVING due regard to the extremely important contribution which the whole electrical industry is making to the winning of the war, it cannot be said that the King's Birthday honours list was unduly weighted with electrical names. The electricity supply section will have been gratified to learn that a knighthood had been conferred on Colonel J. C. Dalton, for his work on behalf of the industry has been strenuous and most valuable, particularly during the past two years or so. The O.B.E. awarded to Mr. R. Illingworth of Poplar is due recognition of his efforts to maintain supply in one of the areas most badly hit during Hitler's unsuccessful attempt to break London's nerve. Mr. R. A. Watson Watt's work on radiolocation and his services as scientific adviser on Telecommunications to the Ministry of Aircraft Production amply justify his knighthood.

Coal Scheme Approved

LAST week's debate on the Government's coal proposals ended, as was expected, in a qualified approval. The Labour speakers doubted whether anything short of nationalisation would achieve the results so urgently required, but most of them in the end accepted the scheme as a move in what they considered to be the right direction. Mr. Hugh Dalton, who will now be relieved of further responsibility in the matter, chose as the theme of his swan song the onus resting on those who had opposed rationing to secure the necessary measures of economy from the public. The electricity supply industry, which found itself unable to welcome rationing, not because it was undesirable but on account of the considerable difficulties attending its operation, will accept the challenge and re-double its efforts of the past year or two.

A Good Send-off

IT had already been advocated that the matter was of sufficient moment for action by the Prime Minister, and Mr. Dalton was able to state that it was hoped that Mr. Churchill would broadcast on the need for economy at an early date. This should give a considerable impetus to the new campaign in which the electrical industry must take a leading part. It may be noted that the domestic coal saving "target" aimed at has been reduced to 6,000,000 tons from Sir William Beveridge's figure of 10,000,000 tons—a not unreasonable figure.

Meter Reading for Consumers

WITH so many women on war work the chances of meter readers finding nobody at home have increased enormously. To get over this difficulty the County of London Electric Supply Co. has adopted a system whereby the consumer is allowed to read the meter himself. If a reader is unable to gain entry he leaves a double postcard. One half, illustrated with meter dials, instructs the consumer how to ascertain his consumption and asks him to complete and return the second half. This also reproduces the dials and all that the consumer has to do is to mark in the positions of the pointers ; the company does the rest. This simple idea should solve the problem of repeated fruitless visits and might be copied by other supply authorities if they are not already doing something similar.

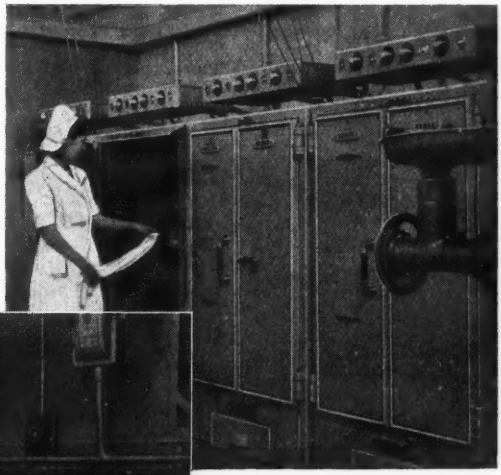
Smoothing the Way

ALTHOUGH it is logical to base the maximum demand charge on the highest consumption in any half-hour during the year, the consequent fluctuations in revenue provide one reason for the unpopularity of the system. It is preferable to relieve consumers, including undertakings receiving bulk supplies, from the burden of taking long views by ironing out such fluctuations in the tariff. In this issue Mr. Bolton argues the case for taking the average of a number of periodic demands and indicates the order of the increase in the kilowatt charge requisite for providing the same payments. The extent of this increase may not always be appreciated.

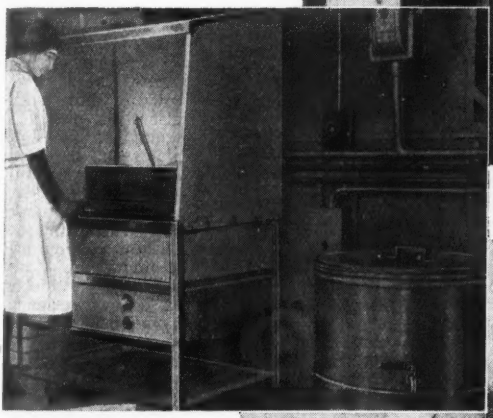
Mass Catering

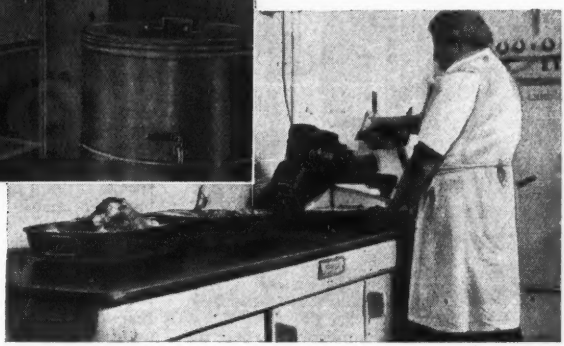
All-electric Equipment at a Coventry Communal Feeding Centre

PROBABLY no other town in the country is better qualified to give advice on emergency feeding on a large scale than Coventry. The first city in the country, apart from London, to experience the effects of a full-scale air-raid involving the temporary paralysis of nearly all public services and the dislocation of normal catering arrangements, it was quick to appreciate the necessity for providing facilities for supplying large numbers of substantial, well-cooked meals cheaply and at short notice. What was thus initiated as an emergency measure has since developed into an essential feature of the city's daily life and seems likely to become a permanent amenity even after the war as one of the means of eliminating work in the home and consequently giving the housewife more leisure.



Bank of four 14-kW electric roasting ovens





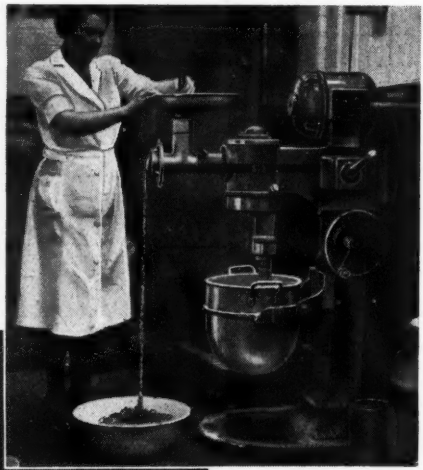
Above: The fish fryer and one of the 30-gal. vegetable boiling pans. Right: Slicing machine for cutting up boned joints, etc.

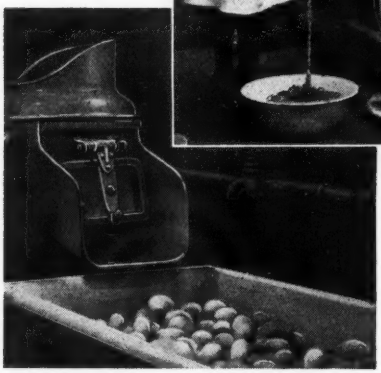
At the largest and most recently completed of the city's communal feeding centres at Butts Pavilion it is a sign of the times as well as of the foresight of the City Council that all the equipment normally employed is electrically operated. In fact, if this were not the case it would without question be quite impossible to maintain the highly efficient service provided, at any rate without substantially increasing the size both of the staff and of the kitchen.

As it is, a staff totalling eighteen in a kitchen with a floor area not much over 2,000 sq. ft. is able, without difficulty, to serve continuously 1,300 meals an hour in

the Feeding Centre, as well as several others sent out to factories and schools. Altogether, in the course of a day, an average of five thousand meals is served in the Feeding Centre and about three hundred to factories. At present schoolchildren account for an additional 650 meals a day, but this number is expected to be increased considerably in the near future.

The Centre is open continuously from 7.30 a.m. to 7 p.m. every day, including Sundays, for breakfasts, lunches and high teas. To give an idea of the charges, a full lunch comprising, say, meat, vegetables, sweet, and a cup of tea costs 11d., each dish being obtainable separately if desired. Portions are generous and there is little waiting. Except in the case of a small separate restaurant on the first floor where there are waitresses and the charges are consequently slightly higher, *e.g.*, 1s. 2d. for the full lunch, service is on the cafeteria principle. Customers enter at both sides of the building, take appropriate tickets at kiosks, pass along in "alleys" in front of the serving counter, collect their food and hand in their tickets to a checker seated at the central point where the two streams of customers from each side meet.





A potato peeler and general-purpose combined mixer and mincer save a considerable amount of time and labour

Small tables each for four persons furnish accommodation for six hundred people at a time. Comfortable chairs have been provided and considerable care has been taken to provide attractive and cheerful surroundings. The walls have been tastefully decorated in cream and buff, while an additional feature which makes an enormous difference to the general appearance of the dining room is the provision of curtains and pelmets in cretonne. The room has its fair share of daylight, but to supplement this there are thirty totally enclosed pendant lighting fittings (Hailwood & Ackroyd), each housing a 200-W lamp.

As already implied, the serving counter is arranged in two identical halves; each has a Jackson combined hot closet and bain marie (10.4 kW) for serving the food and a Stott café set (14.2 kW) for hot water, coffee and milk. To ensure an adequate supply of hot milk there is, as an addition to each café set, a 2-kW boiling ring, while for drinks requiring mixing there is a Horlick's mixer.

In the preparation of meals considerable help is given by a Hobart potato peeler (½-HP motor) and a general - purpose combined mixer and mincer, which reduces manual labour in a number of ways. Roasting is carried out in a bank of four Jackson roasting ovens (14 kW each), a separate double oven (26.75 kW) catering for such dishes as pies and puddings: the hotplates on the last-mentioned apparatus are brought into service for making stews and custards, etc. Dishes requiring steaming are dealt with in a double Jackson steaming oven (10.2 kW). The cutting up of boned joints, etc., can be speedily done by means of a Metcalfe electric slicing machine, which is mounted on a Jackson hot closet (8 kW) provided with special carving wells. After being cut up the food is placed in the hot closet until required at the counter.

Fish and chips are cooked in a G.E.C. 17-kW fish fryer, which, to prevent the smell from getting into the dining room, has been placed in an annexe leading from the rear of the main kitchen. Here, too, in addition to solid fuel boilers for use in case of a failure of the electricity supply, are two Jackson 30-gal., 9.2-kW vegetable boiling pans, four more of which are to be found in the main kitchen. Several storerooms

provide accommodation for the very large stocks of foodstuffs that must be kept available and for perishable food there is a Frigidaire cold room having a capacity of about 650 cu. ft.

Washing up for such large numbers of meals provides something of a problem, but this has been satisfactorily solved by the use of two Hobart dishwashers. These are situated in two washing-up rooms, one at each side of the kitchen, reached by doors immediately behind the serving counter. One of the washing-up rooms is kept entirely for cups cutlery, etc., while the other looks after the plates, serving pans and other large articles.

Controlling the 300 kW or so of connected load is a M. & C. circuit-breaker, with Bill metal-clad subsidiary switch-fuse gear. The electricity supply (230 V, single-phase, AC) is provided by the Coventry Corporation and the whole of the electrical installation work was carried out by the Three Spires Electric, Ltd. The building was adapted by Mr. D. E. Gibson, the city architect.

We should like to thank Mrs. Dunkerley, the superintendent, for allowing us to inspect the Centre, and also Mrs. Pass, the manageress, and Mr. A. W. Arrowsmith, Mr. Gibson's assistant, for helping us in the preparation of this article.

Each half of the serving counter is fitted with a combined hot closet and bain marie, and a cafe set for hot drinks. Right: The washing up problem has been solved by the use of two dish washers

South African Resources and Industry

WHEN surveying the present state and future prospects of industry recently before the South African Institution of Engineers, Dr. H. J. van Eck first indicated the influences exerted by local raw materials and labour resources in order to show that the Union was still too dependent on the importation of large quantities of manufactured products from overseas, including electrical machinery, apparatus, cable, wiring and conduit.

Of all the British Dominions the Union was, in Dr. Eck's opinion, the least self-sufficient, even comparing unfavourably in that respect with most countries in Europe. He instanced the Iron and Steel Corporation established at Pretoria as an outstanding example of the possibilities of complete manufacture from local minerals through the various smelting processes to finishing refinement. In conjunction therewith plant for the electro-thermal manufacture of ferro-manganese (first started in 1932 at Newcastle) as well as ferro-chrome and ferro-silicon was expected soon to be in production at Vereeniging. Wire was already being manufactured from Rhodesian copper, although the Union also produced copper at Messina and O'Okiep.

There was no reason why industries should not be based on readily available ores and coal, by special processes locally suited to relatively cheap minerals, instead of blindly following methods influenced by high cost of imported materials. The power industry of the Union seemed to be the finest guide to what could be achieved by co-operation, rationalisation, mechanisation and large units of production.

PARLIAMENTARY NEWS

By Our Special Reporter

Fuel Rationing

IN the House of Commons on June 9th Mr. Henderson Stewart asked the Parliamentary Secretary to the Ministry of Economic Warfare whether any European country had put into operation a scheme for rationing domestic gas and electricity. He also asked whether any such scheme had been formulated in Vichy France, and what happened to it.

Mr Foot replied that schemes designed to ration or compulsorily to reduce the domestic consumption of gas were now in force in Switzerland, Italy, Holland, Czechoslovakia, Belgium, Greece, Finland, the Baltic States, Denmark and France. Similar schemes for electricity were in force in Holland, Norway, Denmark and France. Italy and Switzerland did not normally ration electricity, but emergency schemes were introduced for a time during the winter, when there was a shortage of water power. Gas and electricity had been rationed throughout the whole of Metropolitan France since September 1st, 1941.

Captain Alan Graham asked the President of the Board of Trade whether, in the interests of coal conservation by a smaller consumption of electric power he would consider introducing legislation to close the gates of all first-floor and top-floor landings in buildings where lifts were used.

Mr. Dalton said that this suggestion would be considered together with others having the same object.

Mr. Walkden, in the course of a question to the President of the Board of Trade, asked whether the rigid covenant and restriction as between gas and electricity undertakings would now be relaxed so as to ensure that the wastage of sludge gas was eliminated.

Mr. Dalton said that there were difficulties in making general use of sludge gas. It had been found in many places that it was most economical to use this gas to supply the requirements of sewage pumping stations. It was also used instead of petrol for transport purposes. He was not aware of any rigid covenant or general restriction preventing electricity and gas undertakings from using the gas if it could be made available.

The Coal Debate

On June 10th Sir John Anderson, Lord President of the Council, moved that the House approve the Government's proposals relating to coal set out in the White Paper (Cmd. 6364) which was reviewed in our last issue. He said that until early in 1941 the coal problem had been one of distribution ; then production difficulties were seen to be approaching.

After dealing with the man-power question Sir John Anderson said that by reorganisation it was hoped to secure a better use of the skill available in the industry, some improvement in mechanisation and a direct increase in production by concentration upon the more productive pits and seams. Unnecessary exports would be eliminated and it was hoped to effect a material saving in industrial consumption.

If the fall in output was arrested and if domestic consumption of coal could be reduced by 6,000,000 tons we should be able to get through the winter and finish with stocks on a safe level. Before domestic rationing was put into operation there would be an opportunity for a further debate on the subject if members desired it.

Mr. Greenwood criticised the proposals, stating that public ownership and control of the the mines was essential in the national interest. He welcomed the Government's decision to set up a Ministry of Fuel. He doubted whether the scheme would produce all the coal needed and foresaw that the Government would eventually have to come forward with more far-reaching proposals.

The debate was continued on the following day when Mr. Dalton, President of the Board of Trade, said that when Major Lloyd George, the new Minister of Fuel, took over he would have a full discussion with representatives of the miners and coal-owners.

The Government had agreed to a postponement of fuel rationing in order to secure the widest possible support for its policy as a whole. But there must be a substantial reduction in coal consumption, including industrial consumption. Those who had opposed compulsory rationing would now have an opportunity of proving their contention that the saving could be made by voluntary means. The Government would give the fullest support to a sustained campaign designed to secure a voluntary reduction in consumption and he hoped that the Prime Minister would be able to broadcast on the subject at an early date.

Although the rationing scheme was being suspended all administrative preparations would be made so that it could be put into operation without loss of time after a final decision had been taken by the House.

In reply to questions by Sir Arnold Gridley and other members Mr. Dalton assured the House that there would be an opportunity for members to discuss the scheme before it was put into operation—both as to whether there should be a scheme or not and on questions of detail.

After further debate an amendment moved by Mr. Maxton calling for the nationalisation of the coal industry was rejected and the proposals were approved.

Housing Estate Design Competition

THE Incorporated Association of Architects and Surveyors is holding its fifth open competition to encourage architectural skill in the design and economic planning of housing for the wage-earning classes and others of moderate means. Particulars of the competition can be obtained from the secretary of the Association, 75, Eaton Place, London, S.W.1, to whom designs must be delivered by January 1st, 1943.

M.D. and Peak Responsibility

How Existing Defects Might be Overcome

By D. J. Bolton

LOGIC is like habit, a good servant but a bad master, and this is nowhere better seen than in the field of electricity rates. So often a tariff which appears to have all the virtues and is logically absolutely watertight proves in practice to be quite unsuitable. Perhaps tariff making (as someone unkindly said of medicine) is an art and not a science at all, and we should do better to recognise it as such.

In the matter of kilowatt-charge assessment there are two entirely different plans. Both are logical; both can be argued most plausibly, to the complete exclusion of any other method. Yet they give results so widely divergent that both cannot be right, and the suspicion arises that perhaps neither of them is quite what we want.

One method (*a*) based on what may be called actual or individual demand, charges for the largest demand occurring in the year (or other assessment period) no matter when it occurs and without any reference to the time of system peak. With the other method (*b*) based on effective or system demand, a load is charged according to its power at the time when the peak is occurring on the system to which it is connected. In the first case diversity is averaged out amongst all the connections, whereas in the second case it is allowed for individually.

The author makes a plea for multiple readings and for some consideration of peak-time characteristics

It is easy to make out an excellent case for either of these plans. In support of method (*a*) it may be said that, after all, demand *is* demand whenever it occurs, and any definition of the term as normally framed would inevitably lead to this form of interpretation. Moreover, if one purpose of a tariff is to reflect the value to the user, as measured by the price he would have to pay elsewhere for the same service, it is clear that this method comes nearest to a use-value representation. Certainly if he generated for himself his peak would cost him so much per kilowatt whether it occurred at mid-day or midnight.

Now consider the arguments in favour of (*b*). Not less important (most people would say more important) than the reflection of service value is the reflection of supply cost. At least with bulk supply and large-scale tariffs, cost representation is the prime consideration. But the costs of supply at any point in a system are the plant charges and operating expenses occurring *before* that point. Only elements antecedent to the point can be said to enter into the costs thereat. For example, the bulk supply cost at a T point in a high-voltage line is the cost of the generation and interconnection up to that point. It follows that the only features upon which the cost allocation can rightly be based are, not the characteristics of the load regarded by itself, but the effects which that load has upon the system, *i.e.*, the number of additional units and kilowatts resulting from it. As regards the fixed costs up to the connection point, therefore, since these are a function of the system peak, a load which contributes nothing to the magnitude of that peak can fairly claim not to contribute to its cost.

It should, however, be emphasised that in suggesting that method (*b*) gives a more accurate allocation of fixed costs, this only refers to the cost of plant which is common to the system as a whole. Anything occurring beyond the point of connection, and referred back to this point for reasons of convenience, should be allocated on the individual demand. In the case of bulk supply from a high-voltage system the switching and transforming costs will usually come into this category.

Just as each method can be logically advocated, so there are sound reasons against them both. In fact, it may be said that either plan if followed exclusively becomes logically untenable. Against method (*a*) it may be argued by the consumer: "Why should I pay a kilowatt charge for the use of plant which would otherwise be lying idle?" A more serious objection to such a plan if consistently pursued is that it allows no positive steps towards filling in the valleys and flattening the peaks of the load curve. If the time-of-day of peak occurrence is entirely disregarded, load factor improvement is not likely to get very far. Reliance only on indirect methods, such as the encouragement of classes of load likely to avoid the peak, can never be so effective as the active intervention of a tariff which takes specific cognisance of time-of-day. Thus it will be found that most undertakings, even if their standing charge is of the straight kilowatt variety, will hesitate to impose this charge on a midnight load. Method (*a*) is then diluted, and the standard kW tariff is supplemented by special off-peak rates.

Method (*b*) is even less suitable as a sole criterion of fixed-cost allocation. A consumer who manages by good luck or skilful

dodging to avoid the particular half-hour of the year in which the system peak arises will incur no fixed charge whatsoever. In the extreme case of several loads which do not overlap, the whole fixed cost is borne by the largest of them, while a small change in magnitude in a later year may swing the entire cost on to some other load. Thus a rigid analysis of the components of the system peak is liable to yield very artificial and erratic results, changing violently from year to year for no apparent reason. So narrow an interpretation of peak responsibility would certainly arouse resentment in the consumer however scientifically justifiable it might appear on paper.

Another objection in practice to the general employment of method (*b*) is the difficulty of its application. Obviously it is a far easier matter to measure a consumer's largest load during a year than to find his load at the time of the system peak. Such a method is therefore hardly applicable to individual consumers although it is feasible for large groups and bulk supplies.

On a further consideration it is found that the faults of both methods are of the same kind and arise from the same cause. Both methods fall foul of that bugbear of supply costing—diversity (though they approach it from different directions), and in both cases the fault is accentuated by the infrequency of the m.d. readings.

Too Short and Infrequent Periods

Perhaps if one asks why there is any difference between the two methods one will appreciate how the trouble arises. If the load curve of the individual consumer were just a miniature replica of the system load curve there would be no diversity, and a measurement of the individual m.d. would give an exact measure of peak responsibility. Method (*a*) would then coincide with method (*b*). But when diversity exists the methods give different results because (*a*) assumes that load factors differ only in magnitude and that diversity can be averaged over all the consumers. Method (*b*) recognises that there are different sorts as well as different sizes of load factor, and that a consumer from 8 a.m. to 6 p.m. is more expensive than one from 8 p.m. to 6 a.m. though his load factor has the same magnitude.

Both methods are liable to give extreme and erratic results because they are both based on what happens during one half-hour in the year (the integration period, either of the particular load or of the system). The period is too short and too infrequent, and it takes no account of probabilities and general habits of consumption. The annual fixed charge then depends on a single occurrence without any inquiry as to whether this occurrence is typical or usual.

One could express the point in the form of the questions: "Which consumer costs more to supply, one who habitually overloads or one who overloads only once in a year?" "Which costs more, one who has a 6-hour peak or one who has only a ½-hour peak?" The answer is the first in each case, because the probability of his overlapping other consumers is much greater—in a word his diversity is less. Method (*b*) it is true, attempts to deal with diversity probabilities by metering at the actual moment of system peak and so getting the actual diversity. But this may vary so much from year to year that, like a too sensitive governor, it "hunts." Both methods make too much depend on a single yearly reading, and are a little like the customs official who picks out one trunk in five and plunges his hand among the suits and linen in the hope of coming across the chance packet of cigarettes or bottle of spirits. It is all very well as a means of detecting evasion of dues, but it is hardly a scientific basis for supply costing.

Suggested Reform

Evidently there is room for improvement in the mechanism of demand reading, and at the same time the basis should be shifted so as to effect a compromise between the two methods described above. The result would no doubt be cruder than method (*b*) but more practical and less jumpy. It would be more scientific than method (*a*) and would go some way towards meeting the grievance of those purchasers whose peaks are entirely non-coincident with the system supplying them.

My proposal can be summed up in two words, multiplication and discrimination. The suggestion in brief is that (1) the annual charge shall be based on the average of a number of readings, and that (2) some, at least, of these readings shall be taken during such times as the system peak is liable to occur.

A mere increase in the number of readings will itself be a considerable gain. It was pointed out in my recent I.E.E. paper that isolated m.d. readings, whether taken on the Merz or the thermal principle, involve serious measurement anomalies which more frequent metering will go far to smooth out. Besides being less fortuitous the result will also be more fair since it will be a better guide to habitual behaviour and the probabilities of peak overlap. Furthermore, it will help to mitigate the harshness resulting from the shortness of the integration period.

But multiplicity alone is not enough; there must also be some degree of time discrimination if the tariff is to work smoothly and equitably. In recent years there has been a number of complaints against the charging methods of the Central Electricity Board. These grumbles usually arise from one of two causes which may be called "snap peaks" and "off-peak peaks." The former could be

sufficiently alleviated by more frequent demand readings, but the latter remains.

There is no point in reviving, or taking sides in, this controversy. If one were briefed for either plaintiff or defendant one would have no difficulty in making out a good case. But legalistic arguments do not assist production,

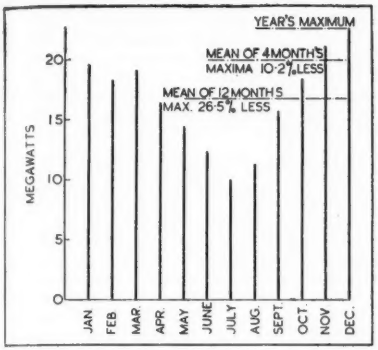


Fig. 1

and what we want to discover is not who is legally in the right, but whether there are legitimate grievances the removal of which would be in the general interest.

Imagine some post-war planner setting out to discover whether it is in the national interest for the citizens of Brighton to do their water heating, or the citizens of Birmingham their cooking, by electricity. An important element in the problem is the cost of supply, and one element in that cost is the fixed charge of generation and transmission. An essential feature of this fixed cost is the fact that the seaside water heating load is likely to reach its maximum in the summer, and the cooking load its maximum on a Sunday. If these relevant facts cannot somehow be reflected in the tariff by which the generation cost is passed across, a load useful to all concerned may never reach its proper development. To devise this reflection without unduly complicating the tariff or upsetting other bulk takers is surely not beyond our powers.

The suggestion here made is that the annual kilowatt charge for bulk supply shall be based on the mean of not less than four and preferably six or twelve readings and that most of these readings shall be taken during hours of potential system peak. Since these hours would presumably not occur during the warmer months or on a Sunday this suggestion would mean that undertakings with a summer or a Sunday peak would find that only part of their fixed cost account was based on these readings, and the remainder on such smaller maxima as were reached during winter week-days.

This suggestion goes further than the one sponsored by the I.M.E.A., namely, that the fixed charge be based on the average of the four m.d. readings taken in January, February, November and December. The latter, while helping the summer-peak undertakings would do little for the Sunday-peak ones whose economic case is exactly the same. On the other hand, a simple average of the twelve monthly readings would be unduly hard on a summer-peak area. A reasonable compromise would be to base the charge on, say, six readings of which four were taken on working days during the winter months.

Counting the Cost

Everything has its price, and it is clear that a reform of fixed-cost allocation will involve not only additional complication in metering and accounting but also a certain revision of the magnitude of the charge. As regards the complication, it is suggested that this is not a serious matter in the case of large-scale supplies, whether bulk for resale or big individual consumers. With smaller power consumers one would usually have to be content with multiple readings (*e.g.*, one per month) without any attempt at time discrimination.

As regards the values, it will be clear that if the demand reading is taken every month, the average of the twelve readings will always be less than the highest of them. Hence if the revenue is to be the same the price must be raised, and the only question is: How much?

Fig. 1 shows graphically the twelve monthly m.d. readings for the last pre-war year in an area with a predominantly domestic load. The lines show the normal effects of darkness and cold weather distribution, added to a certain general load growth. The latter accounts for a partial non-symmetry in the results, as shown, for example, in a higher value for November than for January because it is eleven months later and not because it is a darker or colder month. The year's maximum

TABLE 1.—PERCENTAGE REDUCTION WITH FOUR-MONTH AND TWELVE-MONTH READINGS

	AREA													
	A		B		C		D		E		F		TOTAL	
Year	4-m.	12-m.	4-m.	12-m.	4-m.	12-m.	4-m.	12-m.	4-m.	12-m.	4-m.	12-m.	4-m.	12-m.
1935	13·4	27·8	14·6	32·3	11·5	26·1	18·1	33·7	15·0	30·9	14·8	34·4	14·0	29·9
1936	6·2	21·6	4·2	20·7	9·0	23·7	6·1	23·1	6·2	22·3	4·5	22·3	5·9	21·6
1937	10·2	26·5	10·6	26·4	9·2	22·9	8·8	23·2	9·5	24·0	9·2	27·6	10·1	25·7
Mean	9·9	25·3	9·8	26·5	9·9	24·2	11·0	26·7	10·2	25·7	9·5	28·1	10·0	25·7

of 22·7 megawatts occurred in December, and the average of the four winter months, January, February, November and December was 20.4 MW — 10·2 per cent. less than the maximum. The average of the whole twelve monthly demand readings was 26½ per cent.

TABLE 2

Undertaking	Power sales per cent. of total supplied	Percentage reduction with multiple readings	
		Four-month	Twelve-month
(*a*) ..	49	3·7	22·2
(*b*) ..	42	13·2	29·3
(*c*) ..	35½	4·9	30·4
(*d*) ..	25	12·3	27·0
(*e*) ..	24	14·7	26·3
(*f*) ..	20	16·9	35·7
(*g*) ..	20	8·0	22·8
(*h*) ..	18	8·8	27·8
(*i*) ..	16	6·1	22·7
(*j*) ..	11½	9·4	28·3
(*k*) ..	11	2·3	21·5
(*l*) ..	9	8·8	25·0
(*m*) ..	7	8·6	25·2
Mean of 13	—	9·1	26·5

less than the year's maximum. Thus, in this particular case and for this one year, a charge based on the four winter months (I.M.E.A. proposal) would have to be $\frac{100}{90} = 1{\cdot}11$ times as great (or 11 per cent. higher) per kW in order to bring in the same revenue. Similarly, if based on the twelve monthly readings, it would require to be $\frac{26\frac{1}{2}}{73\frac{1}{2}} \times 100 = 36$ per cent. higher for the same fixed-charge revenue.

Such a casual cross-section is, of course, no general guide, and some further figures are desirable. A survey was therefore made over a six-year period (1935 to 1940 inclusive) of the bulk supply to six different residential areas. The loads were all predominantly domestic in character, and the magnitudes ranged from about 30 MW to just under 1 MW in the last year taken. As might be expected, the war period gave somewhat erratic results, and table 1 shows only the three pre-war years. The figures are based in every case on the highest value for the year, and they express the percentage reduction from this value which would be involved in taking either the four-winter-month, or the twelve-month average. (The areas are arranged in descending order of magnitude, and area A, 1937, already employed in the diagram, will serve as an example of the meaning of the percentage figures.)

One point which the table illustrates is that the figures vary more from year to year than from area to area. Thus the year 1936, due doubtless to an absence of cold snaps, showed uniformly low figures, of the order 6 and 22 per cent., whilst 1935 showed higher figures throughout. Size of area appeared to have little effect on the result.

A further examination was made with the object of seeing whether load character affected the result. In table 2 the figures all refer to a single year, the last before the war (1937). Thirteen undertakings are listed, in the order of their proportion of power sales to total supplies (second column). The sizes varied from 50 MW to 7 MW m.d. in the year of review.

An Unexpected Tendency

Several interesting points begin to emerge from these figures. As regards character of load the results are indeterminate, but there appears a slight tendency for the reduction due to four-monthly readings to be less with the more domestic loads (later part of table 2). This is the opposite of what one might expect. At least as regards the twelve-month average, one would anticipate a greater reduction from the yearly maximum in a purely domestic area than in one with a big industrial load. No doubt that would be the case in a year with an excessive cold spell, but in the ordinary year there seems little or nothing in it. A further analysis covering three areas with graded characteristics in the years 1940 and 1941 (table 3) also showed no such tendency.

Another point which appears in all the results is that there are much bigger fluctuations in the four-monthly than in the twelve-monthly reductions. In fact, in the very great majority of the cases listed, the percentage reduction for twelve-month readings lies between 20 and 30, with an average of about 25. A change from yearly to twelve-monthly readings would then require a fixed charge one-third higher in order to bring in the same revenue.

TABLE 3

Area	Character	1940 percentage reduction		1941 percentage reduction	
		Four-month	Twelve-month	Four-month	Twelve-month
x	Industrial, commercial, domestic, and farming	18·1	27·5	4·5	14·6
y	Some industrial	20·2	23·7	9·4	37·8
z	Almost entirely domestic ..	9·6	26·2	6·5	15·9
	Mean	16·0	25·8	6·8	22·8

So far, one has stressed only the advantages of multiple-demand readings to the purchaser. But the seller also has much to gain therefrom. Not only a satisfied client (no small boon) and less friction and complaints to deal with, but a substantial material benefit also. It is true that at present such bodies as the C.E.B. stand to gain from an occasional windfall in the

shape of exceptional cold snaps. But these chance gains have to be spread over a number of leaner years, and the only certain thing is that the income fluctuates to a degree that is good for neither the recipient nor the payer.

After all, the chief object of fixed charges is to pay for plant costs, and plant is not a thing that can be lifted off a shelf one year and put back again the next. Once plant is purchased, its capital charges are a regular drain whatever use is made of it, and the same applies to most other establishment charges. Far better, then, that the payment be made as far as possible in regular amounts rather than be caused to fluctuate at the caprices of Jack Frost.

In order to investigate this point, the six areas A to F were studied over the six years 1935 to 1940. In the first place the three values for 1935 were set down for each area, namely, the year's maximum, the four-month average, and the twelve-month average. Calling these figures 100 in each case the corresponding values for all the later years were expressed as proportional figures per cent. of 1935. The figures were then plotted in the form of rising zig-zag lines.

Space does not permit the reproduction of these curves, but they show unmistakably that the four-month average (and still more the twelve-month average) fluctuates far less from year to year than does the year's maximum. This is only what one would expect, and the resulting greater uniformity of payment from year to year would assist the accounts both of the purchasing and of the selling authority.

A Post-war Change

Finally, if a change in the basis of fixed charging is desirable, when should it be made? Probably the largest single difficulty in carrying through any tariff change is that, when the total volume of revenue has to be maintained, any adjustment will inevitably raise the price to some purchasers whilst reducing it to others. Much the best time to effect such a change is therefore when there is money in hand and price reductions can be made. The present is a time of rising prices, but after the war one may hope for reductions, and such a time will be ideal for initiating a new tariff policy. Before this can be launched much work must be done on the lines here indicated, and now is the time to do it.

I.M.E.A. Annual Report

Negotiations with the Central Board

THE forty-seventh annual general meeting of the Incorporated Municipal Electrical Association was held in London yesterday under the chairmanship of Mr. J. W. J. Townley (West Ham), the President. The new Minister of Fuel & Power (Major G. Lloyd George) was to be present at the meeting.

Although in briefer form than usual, the annual report which was presented at the meeting is a record of many important activities. The Association has participated in the prolonged discussions of the Government's fuel rationing proposals through the National Gas and Electricity Committee, of which Mr. John Mould (Leicester) is chairman, and which has been consulted by Sir William Beveridge in connection with his report on the matter. The Committee recently submitted alternative proposals which were thought to reduce to the minimum the administrative difficulties attending restrictions on the use of gas and electricity.

A number of meetings of the Joint Committee of Electricity Supply Associations were held during the past year and conferences took place between the Committee and the Electricity Commissioners and other bodies on matters affecting the industry.

New centres have been formed for Central England and North-West England and North Wales and it is hoped to establish a centre for the South-West England and South Wales area during the coming year. Centres will then be operating for the whole country.

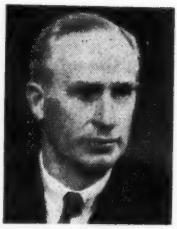
Nine undertakings joined the Association during the year, raising the membership to 347, *i.e.*, 95 per cent. of the municipal undertakings of Great Britain. In recording the deaths of Councillor J. H. Heywood (Huddersfield), Mr. F. E. Spencer (Birkenhead), Mr. N. McLean (Harrogate) and Mr. Faraday Proctor (Bristol) the report makes special reference to the last-named gentleman who was a founder member, president in 1898–99, hon. secretary 1906–19 and hon. treasurer 1919–30.

Success attended negotiations for a reduction in bulk supply charges to members in the North-East England area and the Association gave technical advice and financial assistance in connection with the settlement effected by the South Wales and Monmouthshire Bulk Supply Takers' Association. Negotiations are now in progress in the Mid-East England area and the Association is at present advising members in the North Wales and South Cheshire areas on their bulk supply charges.

At the last annual meeting a resolution was passed asking the Council to urge the Central Electricity Board to offer an alternative grid tariff with the annual kilowatt charge based upon the average maximum demand of the four months of January, February, November and December. In

reply to a communication addressed to it by the Council the Central Board expressed its inability to make any alteration in the form of the grid tariff at present and said it appeared necessary to continue the present tariffs beyond the periods for which they were originally calculated. The Board stated, however, that in the event of its considering alternative methods of m.d. measurement it would consult the I.M.E.A. and other associations. The Council therefore considers that no further action can be taken at the moment, but the matter will be raised again at the appropiate time.

Two matters upon which agreement has not yet been reached, although an early settlement is hoped for, have been under consideration by the GenerationCommittee. They are arrangements proposed by the Central Board (a) to provide for the preservation of existing conditions of supply to selected station owners when their stations are damaged or destroyed by enemy action and (b) to provide for the reimbursement to the Board of the increased costs which it has incurred by reason of the decreased thermal efficiency in wartime owing to the operation of selected stations with regard to continuity of supply rather than economy.



Mr. F. Newey, president I.M.E.A.

The I.M.E.A.-B.E.A.M.A. Joint Committee has had under consideration a formula submitted by B.E.A.M.A. for the application of price adjustment clauses in contracts. The formula has been provisionally agreed but discussions are continuing. The formula will apply to all contracts up to a value of £50,000; for contracts above this figure a modification is being considered.

Coal Quality and Prices

Coal supplies have been the subject of serious consideration during the year. Representations were made to the Mines Department regarding inadequacy of supplies, deterioration of quality and the burden imposed on the industry by wartime increases in prices. The Secretary for Mines appeared to be impressed by the case submitted and said that the question of quality was having the attention of his Department although the increased demand for high-grade fuel made the problem a very difficult one. He promised to give attention to the matters raised and asked the Association to look into the possibility of a scheme for equating excessive transport costs. He also suggested a further meeting when the subjects under discussion had been fully considered.

The Director-General of the Ordnance Survey Department has agreed to waive the payment of royalty in respect of maps prepared solely as duplicate records against the destruction of originals by enemy action.

A draft scheme prepared by the National Committee on Statutory Wiring Regulations and Registration providing for the examining, licensing and registration of contractors and operatives engaged in electrical installation work has been considered. In this connection the Council refers to a decision arrived at in 1939 in which compulsory regulations were approved provided that no additional responsibility was placed on supply authorities in connection with the inspection of installations other than those carried out by themselves. The compulsory registration of contractors, but not operatives, was also approved. The Council saw no reason for departing from this decision but added that in view of the existing difficulty of obtaining labour the present time seemed to be inopportune to put the suggested scheme into operation ; that the Association agreed to the broad principles of the scheme for post-war acceptance ; and that at the appropriate time consideration would be given to the question of the licensing of operatives.

War Damage Insurance

Certain provisions of the War Damage Act, 1941, are not applicable to public utility undertakings and the Bill to deal with them has not yet been before Parliament. Conferences have taken place between the representatives of this and other associations and the Treasury and assurances have been received that their interests will not be affected by the delay as the provisions of the Bill will be retrospective.

The report refers to the publication of a Summary of Emergency Statutes and Orders affecting the Electricity Supply Industry ; the Council's comments on draft British Standard Specifications ; and the work of the Centres.

Brief reports are included of the work of bodies on which the Association is represented, including the Conjoint Conference of Public Utility Associations (coal, war damage, mains and cables in highways, reinstatement of highways following enemy action and national planning and reconstruction) ; the British Electrical Development Association ; the British Electrical & Allied Industries Research Association ; the Electrical Association for Women ; and the British Standards Institution.

The accounts show a total income of £12,012 (against £11,484 for 1940–41) and an expenditure of £10,842 (against £10,183), leaving a surplus of £1,170 (£1,301).

As we have already reported, the new president is Mr. F. Newey (Lincoln) and the vice-president is Mr. W. N. C. Clinch (Brighton).

Dynamo Operation

Ascertaining Causes of Excitation Troubles

By "Rotor"

MANY works' engineers will have experienced trouble due to dynamo voltage failing to build up to normal. The curve AB in fig. 1 shows the relation between the field current of a shunt dynamo and its voltage on no load. The ordinate OA indicates the voltage generated with zero field current, that is due to the residual magnetism retained in the field magnets upon the stoppage of the dynamo.

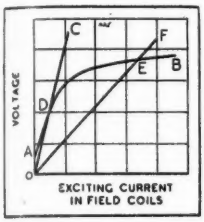


Fig. 1.— Open-circuit characteristic of shunt dynamo

A machine may lose its residual magnetism as a result of shock, stray magnetic field from other apparatus or of reversed current through the field windings. The last might occur with a compound dynamo running in parallel owing to incorrect operation or to current fed back to it when slowing down from a motor having a load of great momentum.

Loss of residual magnetism will prevent a dynamo generating any voltage; if this happens the voltage should be tested at the brushes with a low-reading voltmeter or a low-voltage lamp. Should no voltage be indicated the field magnets can be magnetised by DC from another source, but the current through the field coils must not be interrupted when much over half the normal value as otherwise the high voltage induced when breaking circuit may damage the insulation. A resistance should be inserted in circuit to reduce the shunt-field current, or a resistance (*e.g.*, lamps in series) should be connected across the field coils (fig. 2) and left in circuit until the supply has been cut off the coils.

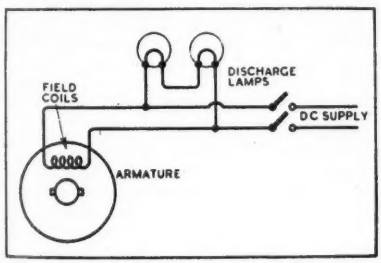


Fig. 2.—Magnetisation of field with normal value of field current

One method is to connect a second dynamo having a voltage the same as or lower than that of the machine requiring attention to the shunt field of the latter and allowing the second dynamo to slow down after passing current and before disconnecting the coils.

Where compound dynamos are working in parallel, one machine can be magnetised from the others by closing the equaliser switch connecting their series field coils and then closing the single-pole main switch on the series field side of the defective machine, leaving the other single-pole switch open. The defective dynamo should then build up to normal voltage.

A further method, applicable to a low-voltage machine, is to connect a battery in circuit with the shunt-field coils. If the battery is connected across the shunt regulator with all the regulator resistance in circuit (fig. 3) the battery can be left in circuit whilst the dynamo is run up to speed and then disconnected without interrupting the field circuit.

In some cases the residual magnetism may become reversed, causing the voltage to build up with reversed terminal polarity. This can often be remedied by reversing the main connections, without alteration of the magnetic polarity.

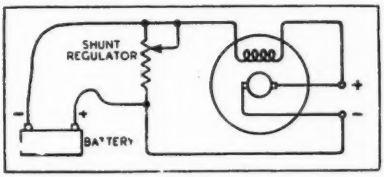


Fig. 3.—Magnetisation of shunt dynamo by means of a battery

Assuming the tests to indicate that a small voltage is generated by the residual magnetism, this should cause current to pass through the shunt-field windings to augment the residual magnetism and cause the machine to build up to normal voltage. The value of field current passed is proportional to the dynamo voltage and inversely proportional to the resistance of the field circuit. The line OC in fig. 1 shows the relation between field current and voltage with a high-resistance field circuit. Above the point D the voltage required to pass a certain field current would be greater than the voltage generated in the

dynamo with that value of field current; hence the intersection at D of the line OC and the curve AB represents the maximum voltage to which the machine would build with such a field resistance.

On the other hand, the line OF shows the

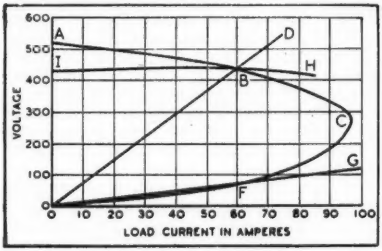


Fig. 4.—Load characteristic curve

relation between dynamo voltage and field current with normal field resistance, E being the voltage to which the machine will build up. Assuming the residual field voltage is being generated, the failure of a dynamo to build up to normal voltage either on no load or on load may be due to the field circuit having too high a resistance, possibly owing to excessive resistance being left in circuit at the voltage regulator. The remedy in this case is to move the regulator to the position for maximum voltage.

Testing for Open Circuit

An open circuit in the shunt field would prevent the voltage rising above that due to the residual field only. This could be tested by connecting a voltmeter across each field coil in turn. Normally each coil should show an equal voltage; an open circuit in a coil is indicated by the voltage across that coil being equal to the residual field voltage, whilst the voltage across the sound coils is zero. Incidentally, this method can be used, when a dynamo is running, to test for a short-circuited shunt-field coil, the voltage across a short-circuited field coil being less than that across sound coils.

Since the voltage due to residual magnetism is only a small proportion of the normal voltage of a dynamo, a rough or dirty commutator, sticking brushes, or brushes with inadequate pressure, may introduce sufficient resistance to prevent building up. In one case a compound dynamo failed to build up to voltage on no load, but would build up on load and then maintain the voltage on no load. The cause was found to be a minute corroded break in one shunt field coil, sufficient to prevent the passage of current when the only voltage available was that due to the residual magnetism. When the load circuit was closed, the load current passing through the series field coils caused the voltage to build up sufficiently to pass the damaged part, after which the machine operated normally.

Reduced speed has a double effect, since the voltage is directly proportional to speed and, in addition, the reduced voltage will reduce the shunt-field current. A slipping belt, incorrect governing, or prime mover of too low power may be the cause of this trouble. If the brushes are not in the correct position the generated voltage will be reduced, and in case of doubt the brushes should be moved round the commutator in either direction and the effect noted.

Wrongly-connected Coils

Should a field coil be wrongly connected the total effective magnetic field of the machine is reduced and the voltage will be less than normal. A reversed series-field coil will cause reduced voltage on load only, whilst a reversed shunt-field coil will cause reduced voltage both on load and on no load. The magnetic polarity of shunt-field coils can be tested by placing a compass needle near each pole in turn whilst the dynamo is running, preferably on no load, to ascertain whether they are alternately north and south. The series field coils of a compound dynamo can be tested with a compass needle, after open-circuiting the shunt field, by running the machine on load as a series dynamo. Alternatively, current could be passed from a battery through the series-field coils when the machine is at rest, using a compass needle as before. For all normal purposes the magnetic polarity of the shunt and series field coils should be the same, so that the series-field coils maintain the voltage on load.

A further simple method of testing the polarity of the series field coils is to short-circuit each coil in turn by a heavy copper conductor, whilst the machine runs on load. If the polarity is correct the terminal voltage will fall slightly as each coil is short-circuited; if incorrect the voltage will rise slightly.

Should the complete set of shunt-field coils be connected in reverse, the magnetism created by the field coils will oppose the residual magnetism and the machine will not build up. In this case the voltage across each field coil will be equal and of very low value. The remedy is to change over the connections at each end of the set of coils. Wrong direction of rotation has a similar effect.

Loading and Voltage

After a shunt-wound machine has built up voltage on no load or light load, an increase of load will cause the voltage to fall due to the effect of current in the armature creating a magnetic field in opposition to that of the field windings, and also due to the voltage drop in the armature which gives reduced

terminal voltage and reduced current in the shunt field. The voltage therefore falls along the curve AB in fig. 4 to a value depending on the load. Overload of the dynamo beyond its normal rating may cause the voltage to fall to the point C at which the machine is unstable and will not hold its voltage.

In the event of overload or short-circuit a dynamo may fail to build up at all, or may build up to a low voltage only. For example, for a dynamo with a rated output of 60 A at 440 V, the full-load resistance of the load circuit would be $\frac{440}{60} = 7{\cdot}3$ ohms. This resistance is represented by the line OD and the point B shows the voltage of the machine on this load. A resistance of 1·3 ohms is represented by the line OG and if the dynamo were run up on such a low resistance (even if it built up at all) the voltage would not be greater than the 78 V indicated by the point F. Thus there are two voltages corresponding to the same load current depending on the resistance of the circuit fed by the dynamo.

Load current increases the strength of the series field of a compound dynamo tending to correct the reduced effect of the shunt field. The voltage on load would therefore be somewhat as indicated by the curve IH.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Inductance Formulæ

IN your issue of May 29th, Professor G. W. O. Howe asks who first worked out the inductance formulæ for stranded transmission lines. Complete calculations are given in "Constant-Voltage Transmission" by H. B. Dwight (published in 1915 by Chapman & Hall, Ltd.), and in "Transmission Line Formulas" by the same author (Constable & Co., Ltd.). My copy is dated 1925, but apparently there was an earlier edition in 1913. Both of these books contain much information of value to those engaged on transmission line calculations in addition to the basic formulæ (American "formulas.")

Mitcham, Surrey. TRANSMISSION.

HAVING recently had occasion to calculate the capacity of a coaxial cable with 7-strand inner conductor, I was very interested in the letter from Professor G. W. O. Howe in your issue of May 29th, and in the reference to the formulæ in the "Electrical Engineers' Companion." My result was, for $D/d > 1.5$, $\epsilon/C = 2 \log_e (D/0.939\ d)$ . . . (1), where d = overall diameter of 7-strand conductor in cm., D = diameter of dielectric, ϵ = relative dielectric constant and C = capacity in e.s.u. per cm. (To convert e.s.u. to $\mu\mu$F, multiply by 1.113.)

It follows that the high-frequency inductance in e.m.u. per cm. for this cable with permeability unity is $2 \log_e (D/0.939d)$, current being restricted to the adjacent surfaces of inner and outer conductors. It does *not* follow that the low-frequency inductance, with uniform current density, is $2 \log_e (D/0.939d) + L_i$ . . . (2), even if the thickness of the outer conductor is negligible, L_i being the "internal" inductance of a circular non-magnetic wire, 0.5 e.m.u. per cm.

The reason for the failure of (2) is that for shapes other than circular the internal inductance becomes indefinite, since part of the magnetic flux traverses both the inner conductor and the surrounding dielectric. Moreover the interstices in the stranded conductor are a further complication, and I should expect that to obtain an accurate result from (2), L_i would have to be increased slightly above the value 0.5.

Similar considerations apply to stranded twin lines, and this is presumably why the formulæ are given as they are in the "Companion." For the capacity of an unscreened stranded twin, account should strictly be taken of the relative position angles of the two conductors; but since the factor 0.939 in (1) is due to distortion of the field in the immediate neighbourhood of the conductor, the following will probably give good accuracy for 7-strand conductors, with $D_1/d > 1.5$: $\epsilon/C = 4 \log_e [(D_1/0.939d) \{ 1 + (1 - 0.882\ d^2/D_1^2)^{\frac{1}{2}} \}]$ . . . (3). Here D_1 is the axial separation; other symbols as before. If this is accurate, the same expression will give the h.f. inductance.

If the l.f. inductance is expressed by a similar adaptation of another standard formula, namely, $4 \log_e (2\ D_1/0.939d) + 2L_i$ . . . (4), it is to be expected by the argument above that $2L_i$ will have to be taken as slightly more than the normal value of 1 e.m.u. per cm. Comparison with the "Companion" formula for seven strands gives $2L_i = 1.03$, which seems reasonable. The inductance formulæ above assume the pitch of stranding to be infinite. For finite pitch an additional term is required, which a rough calculation shows is not always negligible, even for the l.f. cases.

The method used in obtaining (1) permitted also the approximate evaluation of the maximum voltage gradient for the coaxial

cable specified, and the h.f. ("skin") resistance of the 7-strand conductor. The former in peak volts per cm. is 2.82 V/d $\log_e$ (D/0.939 d) . . . (5), V being the applied peak voltage. With infinite pitch of stranding, and symmetrical coaxial return, the h.f. resistance in e.m.u. per cm. of a non-magnetic 7-strand conductor is approximately 2.28 $(f\rho)^{\frac{1}{2}}/d$. . . (6), where f = frequency and ρ = resistivity in e.m.u. ($\rho = 1.69 \times 10^3$ for copper at 60 deg. F.). This is practically equal to the h.f. resistance of a solid circular wire of the same DC resistance, for which the numerical factor in (6) would be $6/\sqrt{7} = 2.268$.

A. L. MEYERS

*London, S.E.*10. (T.C. & M. Co., Ltd.)

Significance of "j"

MR. C. TURNBULL'S suggestion in your issue of May 29th that operators should be defined as fractional powers of 1 ought to be more widely known and used than it is. I find that my students understand vector algebra more easily and use it with greater facility when they are taught to appreciate the polar expressions in addition to the trigonometrical ones. In addition to the operator $1\angle\frac{\pi}{2}$ which we all know as "j," the operator $1^{1/3}$, frequently written as λ, is particularly useful, for this operator rotates a vector through 120 deg., so that symmetrical three-phase vectors can be written down and treated arithmetically, with the help of the operators λ and λ^2. When the student has become used to this notation, he handles three-phase network problems with almost as ready an understanding as he brings to DC networks.

One consequence of Mr. Turnbull's suggestion is interesting. It concerns the value of unit angle. Our textbooks on mathematics say this is the radian, and they are quite right so long as an angle is defined as the ratio of the arc to the radius of a circle. This is the correct definition of an angle in trigonometry, but in vector algebra an angle is not the ratio of two *lengths*, but a difference between two *directions*, and this difference is defined, without mention of length, by the operator $1^{1/n}$. By this definition unit angle occurs clearly when n is unity. It is therefore the full circle.

The truth is that the word "angle" has two distinct meanings. When an angle is the ratio between two lengths we might call it a "trigonometrical angle," or perhaps a "cartesian angle." When an angle is the difference between two directions we might call it a "true angle," a "polar angle" or a "vector angle." If we were to make this distinction consistent and always assign the correct unit value to the appropriate kind of angle, π and its powers or multiples would disappear from many equations. This would lead automatically to what is generally called a "rationalised" system of units. This shows that rationalisation does not necessarily require a purely arbitrary transference of 4π from one side of an equation to another. It would be the inevitable result of a rather pedantic consistency. I am, however, far from advocating such consistency. I shall continue to speak of revolutions per minute, rather than radians per minute, for instance. It is less trouble to have a few superfluous πs in one's formulæ than to pause to consider which type of angle is involved.

University College, Swansea.

REGINALD O. KAPP.

Production and Export

I HAVE read Mr. Sills' article under this title (in the June 5th issue) and also your editorial comments with considerable interest. I do not consider that I am in a position to express any views of importance on the main subject of the article, but I should like to comment on another subject which seems to me to follow directly from it. I refer to the status and remuneration of senior engineers in the large organisations referred to by Mr. Sills.

I support Mr. Sills' view that it is better to have a few large organisations engaged in the manufacture of electrical apparatus than a large number of small ones, because it is no doubt due to the cut-throat competition between the British manufacturers during the lean years before the present war that engineers in industry receive such poor salaries to-day.

I should like to ask a director of any of our large manufacturing groups just what kind of a life they consider it is reasonable for an engineer in one of their companies to expect to be able to live and how it is to be done on the salary usually paid. For example, consider the case (immediately before the war) of a senior engineer of between 30 and 40 years of age in the design, commercial or research departments. He was not likely to be appointed head of a department for many years (if ever), although he may very well have been doing responsible work for which he had received a long and not inexpensive training. He was almost certain to have served his time with the firm for which he was then working or with a similar firm, to have a degree or diploma, and he may have been an A.M.I.E.E. His contemporaries at school were by then probably doctors, dentists, accountants, solicitors, bank officers, as well as mechanical engineers, chemists, etc., and it is interesting to compare his salary with theirs. From my own experience I should say that £400 to £500 is not an over-estimate. I should like to ask our director how he would maintain a suitable standard of living on such a sum.

Mr. Sills points out that all shades of political opinion are against the lowering of the standard of living after the war. Is it

therefore unreasonable to ask that after the war the industry shall be so organised (or reorganised if necessary) that the engineers of the future shall have the social status and remuneration necessary to enable them to take their rightful place alongside their non-engineer friends in the new world order?

Rugby. W. S. PERKINS, A.G.G.I., A.M.I.E.E.

WE must be thankful that Mr. G. F. Sills is careful to point out that the views expressed are personal ones which he has held and discussed verbally for quite fifteen years, although it seems clear that his words of wisdom have fallen upon stony ground, because there are more firms within the electrical industry to-day than ever before.

His article is clearly a diatribe against what he calls the "small firms" and an attempt to explain that the electrical industry would be better off if they were eliminated. He seeks to justify extermination under several heads, one or two of which are far from complimentary, and show a lack of knowledge of elementary economics. It would have been far better if Mr. Sills had adopted a more tolerant attitude because even the most disinterested person could hardly describe the article as a whole as a dispassionate survey of a problem, that is if there is a problem.

After many meetings with officials of firms representing all branches of the electrical industry, I have never detected any desire for the "crushing" or wholesale absorption of the "smaller fry." On the contrary there has always been manifest a sober and amiable recognition by the large firms of the smaller firms' right to be heard.

Where is the support for the assertion that "it is probable that of the pre-war exports of electrical machinery and switchgear about 80 per cent. were carried out by four composite groups"? Why is it "self-evident that the presence of a considerable number of small electrical firms has not been in the true interest of this country"? Mr. Sills' statement regarding pensions schemes is absurd. He would be surprised if he knew how many firms have instituted pension schemes. He says:—"It is quite feasible for the very few really large firms to absorb the personnel of the smaller ones, and what is more important, to give employment to thousands *more* than the total number now employed by the smaller firms." Mr. Sills appears to know how to get a quart into a pint pot. He also implies that large firms retain employees for whom work cannot be provided in their normal or in an alternative department, because of shortage of orders. It is always with reluctance that employees are discharged under these conditions, but after all there are shareholders to be considered, and trade organisations cannot exist on philanthropy alone!

I have yet to be convinced that the creation of monopolies means lower prices and consequently a larger share in home and export business. On the contrary they have the effect of raising prices to obtain larger profits, whereas free competition, with very few exceptions, tends to maintain business on an even keel. Moreover, although Mr. Sills asserts that his article does not clash with the terms of the Atlantic Charter, people who read the article will surely conclude that he advocates the creation of monopolies, or in other words, the eradication of small firms. His article therefore strikes at the very roots of the principles on which the Atlantic Charter has been founded, *i.e.*, the freedom of the individual.

Mr. Sills might give us his definition of a "small firm," and say how he proposes that, even if agreement were possible, the task of closing down small firms could be accomplished, bearing in mind the manifold issues involved.

All discerning engineers will acknowledge the debt which the electrical industry owes to the few very large firms with their research departments and gentlemen with scientific attainments, which enable us to keep abreast of the times and hold our own in these days of rapid change and progress. Mr. Sills must realise that there are ways and means of obtaining remunerative export orders without going to the extremes which he appears to advocate and, no doubt, those responsible have all relevant matters well in hand.

Manchester. WILLIAM BRIGGS, Assoc.I.E.E.

SOME of the large electrical firms can run most of their departments at a loss and supply the deficiency from a highly profitable monopoly established by what I think, are questionable means. This is an immoral condition for the employees. Many of them have bartered their liberty in return for meagre security. The difference between the conditions of employment in a large and small firm is expressed by the distinction between servitude and service.

When the small firm gets bigger, and, parenthetically, all small firms are in the beginning split-offs of big ones, which are in the very nature of things fissiparous, at what point should it arrest its own development so that it does not become monstrous? In my opinion this should occur when the unit has attained the strength of one thousand.

It was ascertained experimentally in the last war that battalions were often very well handled, brigades were not so successful, divisions still less so, and a good army corps commander was very rare; until the enemy was two-thirds beaten, no one, not even Foch, could administer an army group. I

think the industrial phenomenon presents a very close analogy to the military problem.

We must have monster firms to bridge Sydney Harbour, or build a colossal dam. What are they to do in an ordered state? Such firms should not be allowed to tender for or take contracts below £100,000 each and on the ground, if it pleases them, that it is beneath their dignity to do so.

Finally my experience is that the emissary of the monster firm is generally quite unsuitable to deal with a coloured man. We are going to have to deal with black, brown and yellow people and on terms of apparent equality. A representative of a monster firm has his mind always distorted by a false sense of power, just like a Nazi.

*London, S.W.*1. NEVERAGAIN.

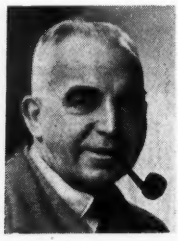
PERSONAL and SOCIAL

News of Men and Women of the Industry

Birthday Honours.—A number of men well known in the electrical and allied industries appear in the King's Birthday Honours List which was published last week and we give their names below.

We offer our congratulations to Col. J. C. Dalton, A.M.I.E.E., F.C.I.S., manager and secretary of the County of London Electric Supply Co., Ltd., and associated companies, who has been knighted. Colonel Dalton is chairman of the Public Utilities Coal Committee, and Fuel and Power Controller for London and South East England. He was one of the originators of the Joint Committee of Electricity Supply Associations, of which he was chairman for a year until November, 1941. He is on the Executive Committee of the London Electric Supply Association, the Provincial Electric Supply Association, and the Electrical Development Association. He retired recently from the Council of the Power Companies' Association and as a member of the London Joint Electricity Authority owing to pressure of Government work. He is a barrister, editor of "Will" on Electricity Law, and honorary colonel, Royal Corps of Signals.

Col. J. C. Dalton



Mr. R. Illingworth

Mr. R. A. Watson Watt

Knighthoods have also been conferred on Mr. A. W. Garrett, Chief Inspector of Factories, Mr. R. A. Watson Watt, C.B., Scientific Adviser on Telecommunications, Ministry of Aircraft Production, Mr. H. Gaskell, O.B.E., M.I.E.E., A.M.I.Mech.E., a director of Imperial Chemical Industries, Ltd., Mr. F. W. Ogilvie LL.D., lately Director General of the B.B.C., Mr. T. S. Kennedy, general manager in Bombay, of Glenfield & Kennedy, and Mr. E. S. Baron, a director of the Palestine Electric Corporation, Ltd. Dr. C. G. Darwin, M.C., Sc.D., LL.D., F.R.S., Director of the National Physical Laboratory, Department of Scientific & Industrial Research, becomes a K.B.E.

Lord Riverdale, chairman and managing director of Arthur Balfour & Co., and a director of the Telegraph Construction & Maintenance Co., Ltd. becomes a G.B.E., while the C.B.E. (Military Division) is awarded to Lieut.-Col. (temporary Brigadier) F. T. Chapman, D.Sc., A.M.Inst.C.E., M.I.E.E., and the C.B.E. (Civil Division) to Prof. A. C. Norman, M.D., Director of the X-ray Institute in Iraq, and Professor of Radiology, Royal College of Medicine, Bagdad, and Mr. C. D. Gibb (C. A. Parsons & Co.), Director-General of Weapon Production, Ministry of Supply.

The O.B.E. (Civil Division) has been awarded to Mr. R. P. Browne, secretary of the Radio Manufacturers' Association, Mr. J. D. Farmer, director of J. & E. Hall, Ltd., Mr. R. Illingworth, engineer and general manager of the Poplar Borough Council electricity undertaking, Mr. F. Ash, Director of Telegraph Stores and Workshops, Alipore, Calcutta, and Mr. H. J. Mulleneux, chief electrical engineer, Great Indian Peninsula Railway, Bombay.

The C.B. is awarded to Mr. J. Innes, M.I.E.E., Director of Telecommunications, G.P.O. ("loaned" to the Mines Department).

In the list of awards of the M.B.E. (Civil Division) appear Mr. J. D. Galliard, A.M.I.E.E., Electrical Superintendent, Mersey Docks & Harbour Board, Mr. P. C. Hinds, works manager, Sperry Gyroscope Co., Ltd., Mr. R. O. Pratt, Chief Officer, H.M. Cable Ship *Alert*, G.P.O., Mr. H. B. Adams, Divisional Electrical Engineer, North Western Railway, Lahore, and Mohamed Siddique Hasan, Assistant Deputy Director-General, Posts and Telegraphs, India.

Following on the resignation, already reported, of **Mr. G. A. Cheetham** from the position of manager of the Instrument and Meter Department of the Metropolitan-Vickers Electrical Co., Ltd., to take up appointment as managing director of Ferguson, Pailin, Ltd., **Mr. T. W. Ross**, A.M.I.E.E., previously assistant chief engineer of the M-V. Instrument and Meter Department has been appointed chief engineer,

Mr. J. T. Thornhill, A.M.I.E.E., previously assistant superintendent, has been appointed superintendent, and **Mr. D. D. Archibald** has been appointed assistant superintendent. Mr. Ross joined the company, then the British Westinghouse Electrical Co., in 1904. He was in charge of the Meter Shops and Test Department from 1916, joined the engineering staff in 1919 with special responsibility for the development of automatic control gear and protective gear, and was appointed assistant chief engineer of the department in 1937. Mr. Thornhill has been with the company since 1921 and after successive appointments in charge of meter and instrument engineering laboratory work, testing, and production, was appointed assistant superintendent of the Department in 1932.

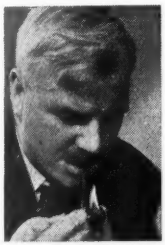
Mr. E. Jordan, until recently district manager of the West Wilts area of the Wessex Electricity Co., Ltd., has been appointed general manager of the Isle of Wight E.L. & P. Co., Ltd., another Edmundson company. He was recently entertained at a farewell supper when cheques were presented on behalf of the staff by Messrs. W. E. Brandreth and W. B. Chivers. Mr. Jordan is succeeded in West Wilts by **Mr. A. F. Hardcastle,** late of the Yorkshire Electric Power Co.

Mr. T. H. Martin-Harvey has been elected deputy-chairman of British Insulated Cables, Ltd. **Mr. B. Welbourn** has been appointed a director of the company.

Lieut. K. J. Townley, R.N.V.R., who before joining the Navy was on the commercial engineering staff of the Birmingham Corporation, has been awarded the M.B.E.

Mr. J. Gray has resigned from the chairmanship of the Madras Electric Supply Corporation, Ltd., for reasons of health. He has been succeeded by **Mr. K. A. Scott Moncrieff,** and **Mr. H. Prior** has also been appointed a director.

Mr. R. O. Ackerley, A.M.I.E.E., who has been elected president of the Illuminating Engineering Society, has for several years taken a leading part in the promotion of the science of illumination, both for industry and the public services. He has a wide and practical knowledge of lighting and is well known as a lecturer on the subject and also as the author of numerous articles in the technical Press. Mr. Ackerley has been associated with the I.E.S. since 1934, and is one of the Society's original Fellows. He has served on the Council for six years, and his election to the presidency follows a period of three years as vice-president.



Mr. R. O. Ackerley

He was a King's Scholar at Eton and served throughout the last war with the South Wales Borderers. He was gazetted captain, and was awarded the M.C. On his demobilisation he joined the General Electric Co., Ltd. and served in the sales organisation of the company, first in London and afterwards for five years with the G.E.C.'s associated company in South Africa. He returned to England in 1929 and two years later took charge of the company's Illuminating Engineering Department, which position he still retains.

At a meeting of the Council of the Institute of Fuel held on June 9th, **Mr. W. M. Selvey,** M.Inst.C.E., M.I.E.E., was invited to continue for another year as president of the Institute. Mr. Selvey has been connected with the Institute since its inception and has for several years been chairman of the Council.

Mr. W. M. Selvey

Mr. C. D. R. Tuckey, assistant works manager of British Timken, Ltd., at Aston, has been appointed works manager of another Timken works. **Mr. H. K. B. Glassey** has been appointed assistant works manager at Aston, and **Mr. J. T. Emmerton,** of the bearing design department, takes Mr. Glassey's former place in charge of planning.

Obituary

Mr. G. S. Francis.—We regret to announce the death of Mr. George S. Francis, who for over fifteen years was the official lecturer of the Electrical Development Association. Mr. Francis, who had been in failing health since the beginning of the war, in the course of his work for the Association had lectured in practically every part of Great Britain and Ireland, and was a well-known and greatly respected figure in the supply industry.

Mr. R. B. Hutton.—By the death of Mr. Richard Blair Hutton of Kelvin, White & Hutton, on June 5th, at the age of 67, a noted figure passes from the nautical instrument industry. Mr. Hutton was a partner in Fenchurch Street of Kelvin, Bottomley & Baird, Ltd., in which position he succeeded his father in 1917. He was associated with the late Lord Kelvin in some of his later experiments. The management of his business will pass to Mr. Ernest Day as part of the association between Kelvin, Bottomley & Baird, Ltd., and Henry Hughes & Son, Ltd., under the title of Marine Instruments, Ltd.

Mr. R. T. Durran.—We regret to record the death of Mr. Richard Thomas Durran A.M.I.E.E., which occurred at Leigh, near Reigate, on June 5th, at the age of sixty-six. Mr. Durran was the representative in Great Britain of public utility undertakings in Argentina and Peru, on whose behalf he carried out many important contracts. He was a member of the London board of the Lima Light & Power Co., a director of the Skefko Ball Bearing Co., Ltd., and other engineering undertakings.

Mr. C. O. Browne.—We regret to report the death, due to an accident, of Mr. C. O. Browne, a television research engineer with Electric & Musical Industries, Ltd. Mr. Browne assisted in the construction of the Alexandra Palace television transmitter.

Mr. H. Rickwood.—The death occurred on June 11th, of Mr. Harold Rickwood, M.I.E.E., temporary senior technical officer with the Admiralty.

COMMERCE and INDUSTRY

Interruptions of Supply. Radio Retail Trade

Export Control

FURTHER classes of good are subjected to export licence by the Export of Goods (Control) (No. 26) Order, 1942 (S.R. & O. No. 1090, price 1d.) which comes into force on June 29th. The list includes the following :—Air conditioning appliances and machinery incorporating fans or blowers ; conveyors, cranes, hoists, lifts, stackers, telphers, transporters and other elevating, handling, hauling, lifting, loading, unloading and winding machinery ; filament lamps, not exceeding 4.5 V ; machine tools not elsewhere specified in the Schedule of Controlled Goods ; parts and accessories of these (including jigs and fixtures) ; and small tools for machine tools.

Interrupted Cinema Supplies

Mr. W. J. Speakman, president of the Cinematograph Exhibitors' Association, mentioned last week the possibility of electricity supplies to cinemas being cut off for a short period without notice. The purpose of the interruption was to reduce the load on power stations, owing to heavy demands of war industries. Owing to the short notice, about 30 minutes, it was impossible for the local engineer to give notice of the temporary cessation of the supply to those who might be affected. Normally, the maximum period of the interruption would be two hours, but circuits would be closed down in turn, so that the trouble would not recur in the same district.

Radio Retailers' Organisation

For some time past the two radio retail trade organisations, the National Association of Radio Retailers, Ltd., and the Wireless Retailers' Association of Great Britain, have been discussing the possible co-ordination of their efforts, bearing in mind that the primary object of both are identical. These discussions have now resulted in an agreement to recommend the memberships of the two Associations to replace their existing organisations by a new one, which it is proposed to call the Radio & Television Retailers' Association (limited by guarantee).

By this concentration, with its consequent elimination of duplication, the radio retail trade will now be able to speak with one voice, which is certain to prove of considerable benefit to the trade as a whole.

The management of the new Association will be in the hands of radio retailers, elected from the general membership. For the time being and until a scheme for electing representatives to the council has been decided upon, a council of fourteen members has been set up, half appointed by the N.A.R.R. and half by the W.R.A. A general meeting of all members will be called within three months, so that members generally may have an opportunity of expressing their views, and at that meeting a scheme for electing representatives to the council will be presented. The secretary of the new body is Mr. H. A. Curtis, Avenue Chambers, 4, Vernon Place, Southampton Row, W.C.1.

An extraordinary general meeting of the Wireless Retailers' Association was held at Manchester on June 11th when resolutions were unanimously adopted approving the setting up of the new association and dissolving the W.R.A. as from June 16th. On that date an extraordinary general meeting of the N.A.R.R. was to be held for the purpose of passing similar resolutions.

Mr. J. H. S. Smith, who presided at the winding-up meeting of the W.R.A., will be the first president of the new organisation. He said that an undertaking had been given by N.E.C.T.A. that it would not in the future operate a rival organisation. The new association represented by the amalgamation would control domestic radio, which, for the present, was defined as sets with an output not exceeding 8 W, but this would not debar the dealer from installing radio receivers above 8 W if the apparatus was obviously of a domestic type, such as radio-gramophones. Amplifying and other commercial apparatus would be in the hands of another association. Domestic radio accounted for 90 to 95 per cent. of the average radio retailer's business.

Untinned Water Heaters

The Electric Water Heater Manufacturers' Association announces that as the Non-Ferrous Metals Control has decided that no more tin will be released for use in the manufacture of electric thermal storage or immersion heaters, these heaters can no longer be tinned.

The Control has notified the Association that the effect of the elimination of tinning has been considered by the Ministry of Health, and it has been decided that the risk to health is so slight that the continued use of tin for electric water heaters is not warranted in the present circumstances.

E.I.B.A. Annual Meeting

The annual general meeting of the Electrical Industries Benevolent Association will be held at 2, Savoy Hill, London, W.C.2., by courtesy of the British Electrical Development Association, at 11.30 a.m., Wednesday, July 8th.

E.I.B.A. is having an up-hill fight in view of the many extra tasks which the war has brought in its train and, of course, the losses of income which are inevitable when so many subscribers have been called to the colours, but the annual report, to be presented at the meeting, will reveal that these services have not been cut in any way; in fact they have been extended to meet the growing needs of the times.

Saving Tungsten

Continuing its campaign among industrialists for economy in the use of tungsten steel, the Machine Tool Control (Ministry of Supply) has circulated an illustrated leaflet (M.T.C. No. 3) setting forth the reclamation and manufacturing processes at the works of Joseph Lucas, Ltd. In this it is shown how the broken teeth of milling cutters can be repaired by atomic hydrogen welding and how high-speed steel

teeth on carbon-steel cutter bodies can be built up by arc welding. Most interesting, perhaps, is the employment of butt welding to join high-speed steel teeth on carbon steel cutter bodies. This not only effects a saving of 50 per cent. in high-speed steel but is a striking testimony to the efficacy of flash butt welding.

Standards for Paper Cables

The revision of B.S. 480, metal-sheathed, paper-insulated cables was started some years ago, but was temporarily suspended shortly after the outbreak of war. The new specification has, however, now been published and a comparison with the 1933 edition shows that the number of sizes of conductors has been reduced; shaped conductors only are now standardised, whereas previously both shaped and circular conductors were provided for; and a single voltage rating of 660 V has now replaced the ratings of 460 and 1,000 V. Taken together, these three features of the new specification will effect a considerable simplification of the types and sizes of cables to be made and stocked. Copies of the new specification, B.S. 480–1942 (3s. 6d., or 3s. 10d. post free), may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1.

Electricity Rationing in Trinidad

The decision of the Trinidad authorities to ration supplies of electricity has raised a number of problems and protests. Apparently, the principal grievance is that the ration is based on previous consumption (90 per cent.), and so those who have wasted energy in the past are given an advantage over those who were economical users. It was this consideration which led to the abandonment of the previous-consumption basis in this country.

In a letter to the *Trinidad Guardian*, Mr. W. Minshall (Port of Spain) contrasts the few stereotyped Press notices appealing for economy published in Trinidad and "radio announcements repeated so often in the same dull words" with the methods of conducting public campaigns in Great Britain (he does not specifically mention the fuel-economy campaign). He maintains that a more vigorous effort would have rendered unnecessary the "outrageous" rationing proposals of the Electricity Board which involve exorbitant surcharges and a risk of a fine amounting to as much as $480.

Electricity Officials' Car Allowances

As a wartime measure the Hammersmith Corporation Executive Committee recommends that the following allowances shall be made to officials of the Electricity Department:—Mr. J. R. Jones, chief electrical engineer, £130 per annum; Mr. B. L. Wells, deputy electrical engineer, £120; Mr. J. Brocklebank, mains superintendent, £70; and Mr. R. A. Blake, consumers' engineer, £70.

Plant Census in New Zealand

With a view mainly to securing particulars of disused or under-used generating and other plant the New Zealand Electricity Controller recently made an Order calling for returns of all generating equipment (including motor-generators and rotary convertors), distribution transformers, conductors and cables in the Dominion. A letter from the Controller, reprinted in the *New Zealand Electrical Journal*, states that it is believed that in the Dominion there is a great and so far untapped source of idle generating plant in freezing works, coal mines, sawmills, factories and other establishments which originally generated their own electric power but have subsequently changed over to public supply.

New Zealand Electrical Imports

During December last the value of imports of electrical machinery and apparatus into New Zealand was £172,127 (N.Z.)—about the same as in the preceding month. In addition there were radio imports (largely from the United States) of about £15,000. Insulated wire and cable was valued at £29,559 (United Kingdom £12,184, Canada £13,978 and the United States £3,146). Electric motors totalled £24,333 in in value (United Kingdom £15,103 and United States £7,310) and electric lamps £9,529 (United Kingdom £8,297 and United States £1,035).

Heating a Large Workshop

In the mechanical maintenance workshop of a large heavy engineering works where slow combustion stoves have hitherto been the sole means of space heating, a battery of twenty-three G.E.C. electric unit heaters has recently been put into commission. Each unit heater is of 20 kW rating and is fitted with a 15-in. fan of low peripheral speed, with adjustable curved louvres for directing the flow of air, and a centre of gravity mounting arrangement permitting horizontal angular adjustment of the heater through 360 deg. The heaters are wound for three-phase supply and are balanced over the three phases.

The scheme is based on maintaining a steady temperature of round about 65 deg. F., assuming an external temperature of 30 deg. F. and two changes of air per hour. The dimensions of the shop are such that the volume of air to be warmed is 255,850 cu. ft. and allowing for a temperature difference of 35 deg. F., the two air changes and the heat losses in the roof (79,900 sq. ft. of corrugated iron), in the walls (13,200 sq. ft. of corrugated asbestos), and in the floor (7,310 sq. ft. of concrete, 6 in. thick), the total BThU required is 1,494,515. The equivalent electrical load is 434 kW.

Each heater is mounted about 8 ft. 6 in. from the floor and is controlled by a triple-pole contactor and an ironclad switch. Each bank of four unit heaters (in staggered positions) has a thermostat operating in the coil circuit of the appropriate contactor. The heater battery of each unit is protected by a fusible link in the contactor-coil circuit.

Magnetic Delay

A steel strip which, when placed under a powerful magnet, waits about a minute and a half before it jumps toward it, is used, it is stated in the *General Electric Review*, to show a delayed change in the steel's atomic arrangement. Knowledge of the nature of such changes is important in making magnetic materials for transformers and other electric equipment.

The strip is a common type of stainless steel containing 18 per cent. chromium, 8 per cent.

nickel, and iron. This metal, known as 18-8, is not ordinarily attracted by a magnet, because it usually contains a little nitrogen. This stabilises the non-magnetic condition of the metal which occurs at temperatures above 1,470 deg. F. and is reached as the steel is prepared. The nitrogen seems to cause friction, which prevents the atoms from rearranging themselves to the phase in which a magnet causes attraction.

If a piece of the nitrogen-free metal is heated to 1,100 deg. F. and then cooled, the magnetic phase does not return until it is down to the boiling point of water, 212 deg. F. Dr. H. H. Uhlig has found that if the heated strip is suddenly cooled by quenching in water and then placed under the magnet, it is not attracted, even though its temperature is lower than that at which the change should occur.

Fatalities

The death of a gunner who received an electric shock while on guard duty was investigated at Winterton last week. It was stated in evidence that the victim, Gunner Sidney W. Clements went outside the guardroom and was later found dead with an electric cable in his hand. The cable in question supplied electricity for lighting the guardroom and ran through a ventilator in the wall. The insulation had become worn. A verdict in accordance with the evidence was returned by the Coroner.

At an inquest in Birmingham on June 10th into the death of a woman it was stated that she was using a vacuum cleaner at the time of her death. Inspection of the machine showed that a strand of wire had made contact with the metal-tube handle rendering it "alive." The woman had apparently held the machine with her left hand, while with the right she moved a coal scuttle containing a connected gas poker, thus earthing the leakage current through her body.

A Corporation electrical engineer said that the handles of portable appliances should be insulated or efficiently earthed. Only a small proportion of Birmingham houses were equipped with three-pin plugs and sockets. The Coroner expressed the view that a representative body should be set up to consider the best means of safeguarding users of such appliances.

A defective vacuum cleaner was the cause of another death, at Glasgow on June 7th. When her husband arrived home for lunch he found the deceased woman lying on the floor clutching the connection of the cleaner.

Control of Rubber

Two further Orders controlling rubber came into force on June 6th. The first, the Control of Rubber (No. 13) Order, brings under control reclaimed and synthetic rubber. The other (No. 14) schedules further goods which may only be produced under licence including "electric base plugs, switch bases or plug bases" and torches.

Continuous Reflector Troughing

The introduction of the 80-W 5-ft. tubular fluorescent lamp has been most opportune at this time of national necessity for improvement in factory lighting, and when adequate attention has been given to layout excellent results have been obtained.

While it might at first appear that the best layout would be that of lamps arranged at right-angles to one another, experience has shown that parallel lines can be completely effective, particularly because continuous lines rather than spaced lamps are convenient both architecturally and for simplicity of wiring and control. An example of continuous reflector troughing is the subject of a recent patent application made by the Metropolitan-Vickers Electrical Co. It consists of a method of coupling and supporting reflector troughing units of standard length, and incorporating the starting gear in pairs of units so as to reduce the necessary number of feed points. The chokes for the lines of lamps are grouped together at convenient points.

Tubular discharge lamps in continuous reflector troughing in a drawing office

The coupling of the reflector troughs is by means of tongues engaging each length with the next, and covers are provided at the joints to enclose the lampholders, giving a neat compact appearance. The starting gear for a unit is attached to one tongue and two sets of starting gear are mounted together between the lamps they control.

To obtain rigidity with the minimum of material the system may include arrangements for attaching the troughing to the conduit runs. Conduit boxes can be incorporated in the conduit run at intervals of two trough lengths (10ft. 10in.) to provide for the feed to each pair of lamps. The line of lamps so arranged may be fixed in any convenient position and its mounting is very much easier and neater than individual suspension of separate units. Installations using "Metrovick" tubular fluorescent lamps, have been made in a number of factories, etc.

Teleprinter Network

L.N.E.R. Installation

THE L.N.E.R. was a pioneer in the use of teleprinters on the British railways and just before the outbreak of war an automatic switching network was installed in the southern area which is the first in the world to incorporate manual supervision facilities.

Supervisor's teleprinter (left) with control panel (centre) and test stroboscope with synchroscope (beyond) the local teleprinter table being at far end of office

The automatic exchange is at Liverpool Street and the outstations are connected to it by ordinary telegraph lines. The number of extensions at present connected is 36, of which 25 are outstation extensions and 11 are local Liverpool Street extensions, comprising eight teleprinters, two reperforators and one automatic sender. The reperforator converts incoming messages to the actual electrical code comprising the received characters, represented by perforations on a paper tape. The tape is fed at convenient periods into the automatic sender, which decodes the perforations into the original electrical impulses and transmits the messages at a constant maximum speed of 66 words per minute.

Local teleprinter table at Liverpool Street exchange showing local reperforator with automatic sender and dial box in left foreground

The supervisory and test positions are at the L.N.E.R. Liverpool Street telegraph office, the former enabling the supervisor to enter any extension, whether engaged or not, for offering urgent messages (trunk offering), and also for performing general supervision duties. The test position incorporates a stroboscope for testing the teleprinter mechanism, a synchroscope for accurately determining machine speeds and a dial speed tester: there are facilities for testing extension lines.

Each outstation is equipped with a teleprinter fitted with commercial type dial, key for releasing the connection at termination of transmission and a red and green lamp to indicate nature of call (incoming or outgoing) apparatus cabinet containing the transmission and switching relays, and a rectifier for energising (80V) transmission and (50V) switching. Direct access is obtained by the calling station dialling the number of the wanted station. The switching together of the appropriate lines is performed automatically by the selectors in the L.N.E.R. exchange at Liverpool Street. At the conclusion of the messages either party may press the release key on the dial box.

Should the wanted station be engaged when dialled, the word "Busy" would be automatically printed back on the calling station's teleprinter. The supervisor may be obtained whether or not the outstation is already engaged with another station and may call any other station by throwing an appropriate key; dialling is not necessary.

During busy periods two methods are available for dealing with the less urgent traffic which ordinarily accumulates, namely reperforator and automatic sender (already mentioned) or the supervisor is able to "camp" any station on to an engaged station's circuit in such a way that it is automatically switched through immediately the engaged one is free.

The telex sender is similar to, and performs the same functions as, the ringing machine in telephony, but is so constructed that the actual words are generated for reception on the teleprinters, "Busy," "Unob" (unobtainable), "Perf" (reperforator), together with the control signals for starting a called teleprinter and releasing connections.

ELECTRICITY SUPPLY

Situation in Eire. Grand Coulee Plant.

Blackpool.—SCHOOL HEATING.—At a meeting of the Education Committee it was reported that owing to the severe restrictions on the provision of electric cable, etc., the electric heating of classrooms at Stanley School was now out of the question.

Cheltenham.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to borrow £4,721 for improving the transformer capacity at various substations.

Crook and Willington.—DOMESTIC SUPPLY FROM COLLIERY PLANT.—The Urban Council has appointed a deputation to meet representatives of Straker & Love, colliery owners, with a view to urging the company to supply electrical energy for domestic use at Oakenshaw. It was reported that electricity was available for street lighting and public buildings but householders had to depend upon paraffin lamps for house lighting.

Hastings. — SWITCHGEAR. — The Electricity Committee has obtained sanction to borrow £2,100 for switchgear modifications.

Macclesfield.—ELECTRIC CAFÉ TO BE CLOSED.—The Corporation has decided to close the Electric House Café, on which there has been a loss of £390 during the last twenty months. The chairman of the Electricity Committee said that he had voted against the café being closed, but when the majority of his committee passed a resolution he must abide by it. A proposal to refer back the matter for further consideration was outvoted.

Watford. — CONSUMERS' DEPOSITS. — The manager has reported to the Electricity Committee that he had conferred with the borough treasurer with regard to the demand for deposits from applicants for new supplies who have not previously been consumers and it was decided to continue the policy of requiring deposits from all such consumers.

Workington.—RECONNECTION CHARGE.—The Electricity Committee recommends that a fee of 5s. be charged for the reconnection of any meter where disconnection has been carried out by the Department due to the non-payment of an account.

Overseas

Canada.—QUEBEC.—The Premier of Quebec stated on May 8th, that there would be no Electricity Bill during the current session. Recently it was stated that the Government intended to bring in a measure for the "nationalisation", after the example of the Ontario hydro-electric system, of all electricity producing companies in the Province.

Eire.—LIFFEY SCHEME PROGRESS.—There is now a hope that the Poulaphouca hydro-electric plant will commence to function in October next, thus reducing coal requirements to a substantial extent. The probable yearly output from the Poulaphouca scheme is 30 million kWh. The total output of the Electricity Supply Board stations in the year ended March, 1941, was 435,864,400 kWh. Of this Ardnacrusha (Shannon scheme) provided 257,328,800 kWh or about 60 per cent., and the Pigeon House station, Dublin, 174,823,900 kWh or 40 per cent.

ANOTHER WARNING TO CONSUMERS.—The Electricity Supply Board issued a new warning to consumers last week that electricity saving is not yet sufficient. The provincial areas, particularly, do not realise the seriousness of the situation and every consumer is urged to make a further effort to economise. The statement says:—"If the restrictions have to be extended, they are likely to seriously affect industry. This would mean a reduction in production—less goods, less wages, and consequent hardship, and want in many homes all over the country." The statement concluded with the threat that "the Board will make every effort to weed out and disconnect from electricity supply the black sheep who, by failure to do their part are threatening to bring additional hardship on families by depriving bread-winners of employment."

NORTH-SOUTH LINK-UP.—It is announced that the scheme for an electrical link-up between Eire and Northern Ireland has been completed by Electricity Supply Board engineers. A transmission line to carry energy from Strabane has been constructed through Lifford, Convoy, Raphoe and other small towns to Letterkenny. As soon as Northern Ireland engineers have completed the work on their side of the border, East Donegal will commence to receive a supply from Northern Ireland. By a reciprocal arrangement Enniskillen and other Northern Ireland towns will be supplied with electricity from Ballyshannon.

United States.—PROGRESS AT GRAND COULEE.—The third 108,000-kW set at Grand Coulee Dam was put into commercial operation recently, which raises the capacity to one-sixth of the ultimate figure. In order to speed up development there it is proposed that two 75,000-kW sets which are being constructed for the Shasta Dam shall be diverted to Grand Coulee so that they will be in operation more than a year earlier than they would otherwise be. Ultimately the two units would be moved to the Shasta Dam.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The British Electric Traction Co., Ltd., reports that the revenue for the year ended March 31st reached a new high record of £767,588, an increase of £19,036 as compared with the preceding year. After providing £105,750 for tax and deducting debenture interest, etc., the net profit is £527,393, a decrease of £4,431. The distribution on the deferred capital for the year is maintained at 45 per cent., less tax, and the preference stockholders receive a participating dividend of 2 per cent., making 8 per cent. less tax for the year. A balance of £8,434 is added to undivided profits account, raising it to £1,983,812.

B.E.T. Electric Supply Co., Ltd., reports a revenue for the year ended March 1st of £76,390, as compared with £77,057 for the preceding year. After deducting debenture interest, management expenses and tax, there is a profit of £44,800 (against £45,581). Reserve receives £13,333, and the dividend for the year is maintained at 4 per cent., leaving £29,627 to be carried forward (against £28,120 brought in).

The Rheostatic Co., Ltd.—In a statement accompanying the annual report, Mr. L. Satchwell, chairman, states that the trading profit is well maintained at £31,407. Taxation accounts for £13,303 and, after providing for depreciation and reserve, the available balance is £7,684. The company is fully engaged and reorganisation due to the changing character of the demand has proceeded during the period under review. At the annual general meeting last Friday the reports and accounts were unanimously adopted and the payment of a dividend of 10 per cent. on the ordinary stock was approved.

Siemens Bros. & Co., Ltd., report a net profit for 1941 of £241,019, a decrease of £21,971 as compared with 1940. This figure is arrived at after providing £142,850 for special wartime expenses, £89,578 for depreciation, £4,222 for directors' fees and adequate provision for taxation and contingencies. The ordinary dividend for the year is again 7½ per cent., and the balance carried forward is £399,620 (against £397,351 brought in).

The City of Buenos Aires Transport Corporation shows a deficit of 12.3 million pesos for 1941, as compared with 13.4 million pesos for 1940, according to the Buenos Aires correspondents of Leng, Roberts & Co. The report states that the Corporation last year concluded new and more favourable contracts for electricity supply as the result of which the 1940 deficit has been reduced to 10.6 million pesos ; the figures for 1941 include those estimated savings of over 3 million pesos. During the past year the legal formalities connected with taking over the assets acquired by the Corporation from its predecessors were completed. Following the conclusion of the negotiations for a loan of 40 million pesos, the Corporation proceeded with taking over further omnibus companies. The terms of the loan provide that a reorganisation plan must be put into practice not later than nine months after the date of the loan contract signed in February, 1942.

The United River Plate Telephone Co., Ltd., reports gross earnings of £4,282,599 for 1941 (against £4,151,785) and a net income of £818,240 (against £807,339). The number of telephones in operation rose from 412,930 to 438,511.

The British Columbia Power Corporation reports a gross revenue of $18,701,685 ($16,951,171) and an operating income of $4,262,785 ($4,292,952). To this is added income from investments, etc., $2,217,405. Class " A " share dividends absorb $2,000,000, and there is a surplus of $72,759.

The London Electric Wire Co. & Smiths, Ltd., proposes to pay a final dividend of 5½ per cent., making 7½ per cent. for 1941 (same). It is also proposed to maintain the interim dividend for 1942 at 2 per cent.

The Ebonite Container Co., Ltd., has announced a final dividend of 5 per cent. and a bonus of 7 per cent., making 17 per cent. for the year (unchanged).

The Eastern Telegraph Co., Ltd., is paying a final dividend of 7½ per cent., maintaining the distribution for the year at 11½ per cent.

W. B. Dick (Holdings), Ltd., is paying a final dividend of 6 per cent., making 10 per cent. for the year (unchanged).

The Telephone Manufacturing Co., Ltd., is maintaining its dividend for the year at 9 per cent. by the final payment of 6½ per cent.

Cable & Wireless (Holding), Ltd., propose again to pay a dividend of 4 per cent. less tax, on the ordinary stock in respect of 1941.

Cable & Wireless, Ltd., is maintaining its dividend for the year at 4 per cent. by a final payment of 2½ per cent., less tax.

The East London Rubber Co., Ltd., reports a net profit of £110,195 for 1941-42 (against £74,796). The ordinary dividend is maintained at 7½ per cent.

The General Cable Manufacturing Co., Ltd., is again paying an interim dividend of 6 per cent.

The Electric Construction Co., Ltd., is maintaining its dividend at 10 per cent.

New Companies

Sam Reisler & Kennedy, Ltd.—Private company. Registered May 26th. Capital, £1,000. Objects: To carry on the business of distributors and repairers of, and dealers, in batteries, accumulators, acids, containers, dynamos, motors, torches, lamps, wireless sets, etc. S. Reisler, 5, Addison Terrace, Victoria Park, Manchester, 14, is the first director. Secretary: H. Salter. Registered office: 52, Clarendon Street, Manchester.

Taylors Accumulators, Ltd.—Private company. Registered May 26th. Capital, £1,000. Objects: To carry on the business of electrical and mechanical engineers, battery manufacturers,

etc. Directors: A. W. Sinclair, Woodside Lane, N. Finchley; P. W. Taylor, 52, Holdenhurst Avenue, N.12; C. Bewsher, R.A.F., Hawkinge, Kent; and C. E. Peczenik, 3, Grosvenor Square, W.1. Registered office: 3, Grosvenor Square, W.1.

Switchgear Accessories, Ltd.—Private company. Registered June 5th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, switchgear apparatus and accessories, whether of metal, wood, vulcanite, plastic or other materials, etc. Subscribers: W. F. L. Skinner, 5, Windsor Place, Cardiff and Winifred I. Griffiths, St. Donats, Ty Wern Avenue, Rhiwbina, near Cardiff. Registered office: 366, Newport Road, Cardiff.

N.C.H.F. Radio, Ltd.—Private company. Registered June 5th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, wireless, television and electrical apparatus and accessories, etc. Directors: H. C. E. Erskine Maconochie, Altcar Lodge, St. Leonards Road, Thames Ditton, Surrey and Major W. H. Berridale-Johnson, 10, Cranes Drive, Surbiton, Surrey. Registered office, 145, Ewell Road, Surbiton.

Companies' Returns

Statements of Capital

Electric & Musical Industries, Ltd.—Capital, £6,266,000 in £460,000 preference stock and £11,612,000 ordinary stock units of 10s. each. Return dated January 14th, 1942 (filed March 2nd, 1942). £460,000 preference stock and 5,805,749 ordinary stock units taken up. £3 10s. paid on 7 ordinary stock units. £3,362,871 considered as paid on £460,000 preference stock and 5,805,742 ordinary stock units. Mortgages and charges: Nil.

J. & F. Stone Lighting & Radio, Ltd.—Capital, £600,000 in 200,000 preference shares of £1 each and 1,600,000 ordinary shares of 5s. each. Return dated December 15th, 1941 (filed February 9th, 1942). 169,535 preference and 1,600,000 ordinary shares taken up. £452,035 paid. £117,500 considered as paid. Mortgages and charges: Nil.

Sciaky Electric Welding Machines, Ltd.—Capital, £15,850 in 15,000 preference shares of £1 each and 17,000 ordinary shares of 1s. each. Return dated December 31st, 1941 (filed March 13th, 1942). 8,000 preference and 17,000 ordinary shares taken up. £8,000 paid. £850 considered as paid. Mortgages and charges: Nil.

White, Jacoby & Co., Ltd.—Capital, £7,500 in £1 shares. Return dated January 14th. 5,794 shares taken up. £3,437 paid. £2,357 considered as paid. Mortgages and charges: £1,200.

Electric Sign Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 22nd, 1941 (filed January 16th, 1942). All shares taken up. £1,000 paid. £4,000 considered as paid. Mortgages and charges: Nil.

St. Mary's (Scilly) Electricity Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated December 16th, 1941 (filed January 15th, 1942). 10,452 shares taken up. £7,435 paid. £3,017 considered as paid. Mortgages and charges: £3,200.

John Spencer, Ltd.—Capital, £75,000 in 10,000 preference and 5,000 ordinary shares of £5 each. Return dated January 5th, 1942. 10,000 preference and 1,027 ordinary shares taken up. £55,315 considered as paid. Mortgages and charges: Nil.

Zenith Electric Co., Ltd.—Capital, £26,250 in 25,000 ordinary shares of £1 each and 25,000 deferred shares of 1s. each. Return dated February 10th, 1942. 25,000 ordinary and 23,334 deferred shares taken up. £5,563 paid. £20,603 14s. considered as paid. Mortgages and charges: Nil.

Increases of Capital

Frank Curtis (Electrical Engineers), Ltd.—The nominal capital has been increased by the addition of £4,900, beyond the registered capital of £100. The additional capital is divided into 4,900 7½ per cent. redeemable cumulative preference shares of £1 each.

Mortgages and Charges

Underwood (Electric), Ltd.—Assignment of proceeds of contracts dated May 21st, 1942, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £700.

Assignment on May 28, 1942, of proceeds of certain contracts, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £1,700.

Drake & Gorham, Ltd.—Charge on proceeds of certain contracts, dated May 21st, 1942, to secure all moneys due or to become due from the company to Barclays Bank, Ltd., in excess of £45,000.

Kelvin-Norton Electric Co., Ltd.—Equitable charge on order moneys due to the company, dated May 28, 1942, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Receiver Released

Holroyd (Glassware & Lighting), Ltd.—Reginald J. Osborne of 1, Guildhall Chambers, Basinghall Street, E.C.2, ceased to act as receiver and manager on May 28th, 1942.

Bankruptcies

G. F. Barnes, electrical and radio engineer, 1,102 London Road, Leigh-on-Sea.—Discharge granted subject to bankrupt consenting to judgment for £50 being entered against him by the Official Receiver.

G. W. Linsell, Tippendale Lane, Park Street, near St. Albans, lately carrying on business at 26, London Road, St. Albans, radio and electrical dealer.—Supplementary dividend of 6½d. in the £, payable June 18th at 29, Russell Square, London, W.C.1.

Liquidations

Lomax & Samways, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Titterton, 79a, Wellington Road South, Stockport.

Sparkbrook Radio, Ltd.—Meetings July 10th at 5, Waterloo Street, Birmingham, 2, to receive an account of the winding-up by the liquidator, Mr. A. W. Watson.

STOCKS AND SHARES

TUESDAY EVENING.

THE character of the war news continues to determine the course of Stock Exchange prices to a great extent. Towards the end of last week, developments in Libya and in Russia had a slightly depressing effect. This, however, proved to be temporary. The Government cheap money policy maintains quotations of gilt-edged stocks. London Electric Transport 2½ per cent. is better at 96: Central Board 3½ per cent. stock shows a 10s. rise at 99½. On the other hand, London Passenger Transport stocks are not quite so firm, and Southern Railway 5 per cent. preference at 107½ is a point lower. Southern Railway 5 per cent. preferred hardened to 65½. British Electric Traction deferred, at 955, is 10 points up on the excellent figures in the report to be presented to the meeting on Friday this week.

Profits and Prices

Siemens, at 27s. 6d., have recovered the dividend of 9d. per share net. The decrease of £21,900 in the net profits for 1941 is considered not very surprising, in view of war conditions. Equipment and manufacturing shares are generally better. Rises have occurred in amongst others, Chloride Electrical Storage, Mather & Platt, Lucas, Tube Investments, and Crabtrees. Walsall Conduits reported lower net profits of £76,900 for 1941, but maintained the dividend for the year at 55 per cent. and the price, at 33s. 9d. ex dividend, shows recovery of the deduction. Speculation continues active in E.M.I. shares, which have risen to 16s. 6d. E. K. Cole are better at 11s. 6d.: there is a demand for shares in the companies dealing with wireless in any of its branches. Ever Ready hold their improvement at 32s. 6d. At 25s. Keith Blackman ordinary are rather better, on the increase to 20 per cent. in the dividend. The 5½ per cent. preference are unchanged at 23s. 9d.

Callender's Cables

Callender's Cable shares are a firm market, on the company's notification of its intention to redeem its 4½ per cent. debentures at 110 on November 30th next. The redemption monies will be paid at the option of the holder of the stock on July 31st, together with interest in respect of the period July 1st to 31st, 1942. Of the 4½ per cent. debenture stock there is £300,000 outstanding, redeemable at 110 at any time upon the company's giving six months' notice. For some time past the price of the stock has been standing in the neighbourhood of 107 and, on the company's decision it has moved up, of course, to the neighbourhood of 110. This adds one more example to the other instances already quoted, of the readiness of companies to take advantage of the Chancellor of the Exchequer's permission for existing stock issues to be replaced, where this can be done under the articles, either by cash or by stock that gives a lower rate of interest.

Brush Electrical Shares

During the past few business days a line of 10,000 Brush Electrical Engineering ordinary shares came on offer in the Stock Exchange at 5s. 6d. The shares attracted attention and were absorbed fairly rapidly. The permission of the Stock Exchange Committee to deal in the new issues of preference and ordinary capital is to be sought at an early date. The company returned to the dividend list with 6 per cent. on the ordinary. For the year last ended, Brush earned nearly 40 per cent. on its ordinary capital—almost twice as much as that in the previous twelve months. At the present price and with the payment of a 6 per cent. dividend, the yield on the money comes to £5 4s. 3d. per cent.

Cable and Wireless

Declaration of a 4 per cent. dividend on the ordinary stock of Cable and Wireless (Holding) has now been made, and the immediate effect was to bring down the price of the ordinary stock by a point or so; then, on good buying, it rose to 61 ex dividend. Prior to the announcement, vague optimism had circulated an anticipation of the company paying 4½ or 5 per cent. on the ordinary. This seemed, to the more cautious mind, to be oversanguine. The 4 per cent. dividend may be said to fulfil all reasonable expectation. The market undercurrent appears to be sufficiently firm to warrant the impression that the price will be taken a few points higher when the accounts are out, and the stock settles down to its ex-dividend quotation. The price of the preference stock is 2 points better at 102.

Dominion and Overseas

Mexican securities have been in demand on the extension by the United States to Mexico of the Lease-Lend facilities. This gave Mexican issues a better standing and, followed as it was by an interest payment of 6¼ per cent. by the Mexican Light & Power Co. on its second mortgage bonds, the credit of Mexico has become materially strengthened. Mexican Light & Power seconds, which earlier in the year were 40, are now 62. In the Indian group, Calcutta Electric Supply shares rose 3s. to 28s. 9d., some 10s. above their recent lowest. Maintenance of the 7 per cent., free of tax, dividend is, of course, the reason for the sharp recovery in the price. Madras Electrics are unchanged at 18s. 9d.; Calcutta Trams have followed Calcutta Electric Supply, and at 18s. 3d. are 9d. better. Palestine Electric " A " shares gained half-a-

(*Concluded on page* 805)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price June 16	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	53/9	..	4 13 0
British Power and Light	6	6	28/6	..	4 4 3
City of London	7	7	27/6	..	5 1 9
Clyde Valley	8	8	40/–	..	4 0 0
County of London	8	8	37/6	..	4 5 6
Edmundson's:					
7% Pref.	7	7	35/–	..	4 0 0
Ord.	6	6	28/6	..	4 4 3
Elec. Dis. Yorkshire	9	9	42/–	..	4 5 9
Elec. Fin. and Securities	12½	12½	48,9	..	5 2 6
Elec. Supply Corporation	10	10	45/–	..	4 9 0
Isle of Thanet	2	Nil	11/3	..	—
Lancs. Light and Power	7½	7½	35/–	..	4 5 9
Llanelly Elec.	5½	5½	22/6	..	4 17 9
Lond. Assoc. Electric	4½	4	19/6	+9d.	4 2 1
London Electric	6	6	25/–	..	4 16 0
London Power Red. Deb.	5	5	105½	+1	4 14 7
Metropolitan E.S.	8	8	36/3	..	4 8 6
Midland Counties	8	8	39/6	..	4 1 0
Mid. Elec. Power	9	9	42/–	..	4 5 9
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec. Ordinary	7	7	31/3	..	4 9 7
7% Pref.	7	7	34/6	..	4 1 2
Northampton	10	10	47/–	+9d.	4 5 1
Notting Hill 6% Pref. (£10)	6	6	9	..	—
Northmet Power:					
Ordinary	7	7	35/9	..	3 18 4
6% Pref.	6	6	32/–	–6d.	3 15 0
Richmond Elec.	6	6	25/–	..	4 16 0
Scottish Power	8	8	39/6	..	4 1 0
Southern Areas	5	5	21/3	..	4 14 0
South London	7	7	27/6	+1/6	5 1 10
West Devon	5	5	21/3	..	4 14 0
West Glos.	4½	3½	20/–	..	3 10 0
Yorkshire Elec.	8	8	40/–	..	4 0 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/9	..	—
Calcutta Elec.	7*	7*	28/9	+3/–	4 17 5
Cawnpore Elec.	10	10	25/–	..	8 0 0
East African Power	7	7	27/–	..	5 3 8
Jerusalem Elec.	7	5	18/9	..	5 6 8
Kalgoorlie (10/–)	7½	7½	7/6	..	10 0 0
Madras Elec.	6*	4*	18/9	..	4 5 4
Montreal Power	1½	1½	24	..	6 5 0
Palestine Elec. "A"	Nil	Nil	21/3	..	—
Perak Hydro-elec.	6	7	7/6	+½	—
Shawinigan Power	83cts.	90cts.	15	..	—
Tokyo Elec. 6%	6	6	12	..	—
Victoria Falls Power	15	15	77/6	+½	3 17 5
Whitehall Inv. Pref.	7½	5	15/9	..	6 7 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price June 16	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110½	..	4 10 6
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	107½	..	4 3 7
1963–93	3½	3½	103½	..	3 7 8
• 1974–94	3½	3½	99½	+½	3 5 4
London Elec. Trans. Ltd.	2½	2½	96	+1	2 12 1
London & Home Counties 1955–75	4½	4½	112	..	4 0 4
Lond. Pass. Trans.:					
A	4½	4½	116½	–1	3 17 3
B	5	5	113½	–1	4 8 4
C	3	2½	40½	..	7 2 0
West Midlands J.E.A. 1948–68	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	112½	..	5 6 8
Def.	1½	1½	26	..	5 15 5
Anglo-Portuguese	8	8	18/9xd	..	8 10 8
Cable & Wireless:					
5½ Pref.	5½	5½	102	+2	5 7 10
Ord.	4	4	61xd	+1	6 11 2
Canadian Marconi $1	Nil	4cts.	5/–	..	3 7 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	27/6	..	—
Pref.	6	6	27/6	..	4 7 5
Great Northern Tel.:					
(£10)	Nil	Nil	14½	..	—
Inter. Tel. & Tel.	Nil	Nil	3½	..	—
Marconi-Marine	7½	7½	28/9	..	5 4 4
Oriental Tel. Ord.	11½*	16	45/–	..	7 2 3
Telephone Props.	6	Nil	10/–	..	—
Tele. Rentals (5/–)	10	10	9/–	+3d.	5 11 1
Traction and Transport					
Anglo Arg. Trans.:					
First Pref. (£5)	Nil	Nil	5/–	..	—
4% Inc.	Nil	Nil	12½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	955	+10	4 14 3
Pref. Ord.	8	8	180	..	4 9 0
Bristol Trams	8	10	46/3	..	4 6 4
Brazil Traction	$1	50c	15	+½	—
Calcutta Trams	8	5½	18/3	+9d.	6 0 9
Cape Elec. Trams	5	5	20/–	+6d.	5 0 0
Lancs Transport	10	10	43/9	..	4 11 4
Mexican Light:					
1st Bonds	5	5	83½	+1	5 19 9
Rio 5% Bonds	5	5	98	+½	5 2 0
Southern Rly.:					
5% Prefd.	5	5	65½	+1	7 12 8
5% Pref.	5	5	107½	–1	4 13 0
T. Tilling	10	10	50/–	..	4 0 0
Tilling & B.A.	7*	6½*	55/–	..	2 7 3
West Riding	10	10	39/6	..	5 1 3

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price June 16	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron Elec. Ord. ..	Nil	7½	23/–	–1/–	6 10 5
Assoc. Elec.:					
Ord.	10	10	45/9	..	4 7 6
Pref.	8	8	29/6	–6d.	4 1 0
Automatic Tel.& El.	12½	12½	52/–	..	4 16 3
Babcock & Wilcox .	11	11	42/6	..	5 3 6
British Aluminium .	10	10	44/6	..	4 10 1
British Insul. Ord. .	20	20	93/9	..	4 5 6
British Thermostat (5/–)	18½	18½	16/3	..	5 13 10
British Vac. Cleaner (5/–)	12½	10	11/3	..	4 9 0
Brush Ord. (5/–) ..	Nil	6	5/9	+3d.	5 4 3
Callender's	15	15	73/9	..	4 1 9
Chloride Elec. Storage	15	15	73/9xd	+1/–	4 1 4
Cole, E. K. (5/–) ..	Nil	7	11/6	+3d.	3 0 10
Consolidated Signal	17	17	72/6	..	4 3 8
Crabtree (10/–) ..	17½	17½	30/–	+6d.	5 16 8
Crompton Parkinson Ord. (5/–) ..	30	20	22/6	..	4 9 0
E.M.I. (10/–) ..	Nil	6	16/6	+3d.	3 12 9
Electric Construction	10	10	34/6	..	5 16 0
Enfield Cable Ord. .	12½	12½	55/–	..	4 11 0
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric ..	10	10	41/3	–9d.	4 17 0
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–). .	22*	20*	41/3	..	2 8 6
Ever Ready (5/–) ..	40	40	32/6	..	6 3 0
Falk Stadelmann ..	7	7½	22/–	..	6 16 4
Ferranti Pref. ..	7	7	27/6	..	5 1 10
G.E.C.:					
Pref.	6½	6½	33/9	..	3 14 2
Ord.	20	17½	83/9	..	4 3 9
Greenwood & Batley	15	13	30/–	..	8 13 4
Hall Telephone (10/–)	10	12½	20/–	..	6 5 0
Henley's (5/–) ..	20	20	22/6	..	4 9 1
4½% Pref. ..	4½	4½	22/6	..	4 0 0
Hopkinsons ..	15	15	48/9	..	6 3 0
India Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	107/6	..	5 11 6
Johnson & Phillips	15	15	60/–	..	5 0 0
Lancashire Dynamo	20	20	67/6	..	5 18 4
Laurence, Scott (5/–)	15	12½	9/–	..	6 19 0
London Elec. Wire.	7½	7½	28/3	..	5 6 2
Lucas, J.	15	15	67/6	+1/4	4 9 0
Mather & Platt ..	10	10	40/–	+6d.	5 0 0
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	93/9	+1/4	4 5 3
Pye Deferred (5/–).	25	25	15/–	..	8 6 8
Revo (10/–) ..	5	20	28/9	..	6 19 2
Reyrolle	12½	12½	57/6	..	4 7 0
Siemens Ord. ..	7½	7½	27/6dx	+9d.	5 9 3
Smith, S. (1/–) ..	50	37½	7/6	+6d.	5 7 2
Strand Elec. (5/–)..	2	4	3/6	..	5 14 4
Switchgear & Cowand (5/–) ..	15	10	10/–	..	5 0 0
T.C.O. (10/–) ..	Nil	5	15/–	..	3 6 8
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg. (5/–)	9	9	9/3	..	4 17 3
Tube Investments .	23½	20	83/9	+1/4	4 15 6
Vactric (5/–) ..	Nil	Nil	6/–	..	—
Vickers (10/–) ..	10	10	16/3	..	6 3 3
Ward & Goldstone (5/–)	20	20	18/6	..	5 8 3
Westinghouse Brake	10	10	47/6	..	4 4 2
Walsall Conduits (4/–)	55	55xd	33/9	+9d.	6 10 4
West, Allen (5/–) ..	7½	7½	5/9	..	6 10 5

*Dividends are paid free of Income Tax.

Stocks & Shares (*Continued from page* 803)

crown, rising to 21s. 3d. on the hope that dividends may shortly be resumed. Victoria Falls Power ordinary at 77s. 6d. are equally higher, their firmness being assisted by the declaration of a batch of satisfactory dividends by the South African mining industry.

Foreign Affairs

Amongst the few Stock Exchange markets that have recently been active, are those for the stocks and shares in South American companies. The rise in Anglo-Argentine Tramways debenture stocks stands out with prominence. The speculator has been turning his attention to these, to Brazilian Tractions, and to a few other South American issues which possess a market in London. It would appear, however, from the latest advices that Latin American States are becoming more and more handicapped by the shortage of shipping facilities. The transport difficulty is the chief problem which confronts the Argentine Republic, Brazil, Chile and other South American States. Were it not for this, South American countries should be doing very well. The transport problem reacts upon trade and industry in a number of ways. Nevertheless, the Brazilian Traction Co. succeeds in making substantial progress, its aggregate gross earnings from the beginning of this year to the end of April being $1½ millions up, and showing a net increase of $757,000. The shares are ⅝ up at 15. Anglo-Argentine Tramway income debenture has risen to 12½.

Enemy-Held

Perak River Hydro-Electric shares have risen half-a-crown to 7s. 6d. They can still be dealt in, notwithstanding the fact that the company's property is in enemy hands. These £1 shares attract an occasional buyer who is looking to post-war possibilities. It says a good deal for the confidence with which investment regards the outlook, that there should be money available for employment in the shares of companies such as this. Similar conditions apply in the rubber market, where buyers are now ready to pick up shares in companies whose properties are known to be in Japanese possession, and whose future depends upon factors at present shrouded in uncertainty.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1940

13032. "Remote control receiving apparatus operating according to the frequency of impulses method." Landis & Gyr Soc. Anon. August 16th, 1939. (545319.)

14264. "Electric cables." British Insulated Cables, Ltd., and J. C. Quayle. September 17th, 1940. (545354.)

16420. "Controlling means for variable-speed power transmission apparatus." H. F. Hobbs. November 13th, 1940. (545325.)

16520. "Compositions of matter suitable for use as dielectrics and other purposes." E. I. Du Pont de Nemours & Co. November 20th, 1939. (545356.)

16550. "Transmission of communications." Akt.-Ges. Brown, Boveri & Cie. July 26th, 1939. (545357.)

16615. "Suction cleaners." Hoover, Ltd. November 18th, 1939. (545327.)

16687. "Semi-indirect lighting fittings." G. Campbell and Benjamin Electric, Ltd. November 20th, 1940. (545358.)

16738. "Thermal electric switches." G. F. Burgoyne and W. J. Warren. November 21st, 1940. (545385.)

17136. "Electric circuits for improving the power factor in the case of intermittent alternating current loads." British Thomson-Houston Co., Ltd. November 30th, 1939. (545294.)

17553. "Electrical precipitating apparatus." Westinghouse Electric International Co. December 13th, 1939. (545332.)

17606. "Electric ignition apparatus for internal-combustion engines." J. Lucas, Ltd., E. A. Watson and J. A. Laird. December 12th, 1940. (545361.)

1941

268. "Operation of high-pressure mercury-vapour electric-discharge lamps." British Thomson-Houston Co., Ltd., and H. K. Bourne. January 8th, 1941. (545388.)

290. "Electrical apparatus with compressed air insulation." Akt.-Ges. Brown, Boveri & Cie. January 13th, 1940. (545297.)

381. "Electron-discharge devices." British Thomson-Houston Co., Ltd., H. K. Bourne and E. J G. Beeson. January 10th, 1941. (545389.)

503. "Prevention of ice formation on aircraft." British Thomson-Houston Co., Ltd., H. N. Sporborg and L. J. Clark. January 14th, 1941. (Addition to 525452.) (545298.)

742. "Electric measuring instruments." H. S. Macdie and Automatic Coil Winder & Electrical Equipment Co., Ltd. January 20th, 1941. (545391.)

842. "Contact breakers for magneto-electric machines." British Thomson-Houston Co., Ltd., and L. Griffiths. January 22nd, 1941. (545364.)

931. "Control systems for electric motors." British Thomson-Houston Co., Ltd., and H. V. Benns. January 23rd, 1941. (545392.)

2817. "Telephone systems." Siemens Bros. & Co., Ltd., and D. A. Howard. March 3rd, 1941. (545304.)

3146. "De-icing of rotatable parts of aircraft." British Thomson-Houston Co., Ltd., L. J. Clark and J. H. Walker. March 7th, 1941. (545305.)

4116. "Devices for operating or transmitting code signals." Londex, Ltd., W. S. F. Brown and W. Stern. March 27th, 1941. (545399.)

4999. "Electric-discharge devices for producing ultra-violet radiation." Hanovia, Ltd. May 9th, 1940. (545311.)

5353. "Amplitude range control in a signal transmission system." Standard Telephones & Cables, Ltd. May 2nd, 1940. (545401.)

5354. "Amplification of electric waves by space discharge devices." Standard Telephones & Cables, Ltd. April 26th, 1940. (545343.)

5723. "Electric signal transmission systems." Standard Telephones & Cables, Ltd. June 6th, 1940. (545313.)

5883. "Electrical energy transference systems." Electrical Research Products, Inc. May 11th, 1940. (545402.)

6349. "Fluid-cooled electric-discharge devices." British Thomson-Houston Co., Ltd. May 18th, 1940. (545404.)

6472. "Traffic control signals." F. A. Langley. May 20th, 1941. (545347.)

6665. "Mechanism for acting on dial pointers of wireless sets." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken.) May 23rd, 1941. (545314.)

6683. "Photographic plate changers." British Thomson-Houston Co., Ltd. May 25th, 1940. (545348).

6685. "Ignition apparatus for internal-combustion engines." J. Lucas, Ltd., and J. A. Laird. May 24th, 1941. (545374.)

6981. "Electric vacuum cleaner." Van Der Heem N.V. May 7th, 1940. (545316.)

7175. "Printing telegraph apparatus." Creed & Co., Ltd. June 18th, 1940. (545317.)

9088. "Electric immersion heaters." British Thomson-Houston Co., Ltd. July 19th, 1940. (545349.)

11339. "Blocking layer rectifiers." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken.) September 4th, 1941. (545378.)

11384. "Gaskets for refrigerator cabinets or the like." British Thomson-Houston Co., Ltd. September 7th, 1940. (545407.)

13233. "Blocking layer cells." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 14th, 1941. (545380.)

Amended Specifications

527915. "Automatically variable audio correction circuits for wireless receivers, etc." Marconi's Wireless Telegraph Co., Ltd., and others.

528494. "Insulators for overhead electric cables, etc." A. Wiseman.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — QUEENSLAND. — August 20th. Townsville. 3,000-kW turbo-alternator (Specification 119). A. Robertson, town clerk, Townsville.

Newcastle-on-Tyne.—City Council. Twelve months' supply of electric lamps. Particulars from the clerk of the Contracts Committee, 127, Pilgrim Street.

South Africa.—SALISBURY.—August 26th. Electricity Supply Commission. Plant at Umniati River generating station. (Contract 31/1942.)

Wolverhampton.—July 1st. West Midlands Joint Electricity Authority. 11,000-V overhead transmission line and 11,000-V underground cables. (June 5th.)

Orders Placed

Glasgow.—Police Committee. Accepted. Signal generator (£105) and output power meter (£33).—Marconi Instruments, Ltd. Meter for servicing wireless equipment (£17).—Automatic Coil Winder & Equipment Co. Emergency generating equipment: mobile plant (£215).—R. A. Lister & Co.; trailer unit (£48).—Brockhouse & Co.

Gas Committee. Accepted. Installation of electric cable, transformer and switches for electric power from works to gas compressors (£2,366).—Bairds & Scottish Steel.

Lichfield.—Electricity Committee. Contracts extended for 12 months :—Conductors.—Henley's. Cables.—Standard Telephones & Cables. Poles.—Calders, Ltd. Street lamps.—G.E.C.

Sunderland.—Corporation. Accepted. Installation of a mechanical ash-handling plant and flue dust extraction plant at generating station :—Drag link water trough mechanical ash-handling plant (£7,250).—R. Dempster & Sons. Dry air suction flue dust extraction plant (£3,675).—Sturtevant Engineering Co.

Wolverhampton.—Electricity Committee. Accepted. Two 200-kVA and four 300-kVA transformers (£1,203).—Electric Construction Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bangor (Northern Ireland).—Site for additional hospital accommodation for Bangor Hospital, Castle Street ; A. Scott, hon. secretary.

Bideford. — British Restaurant, Pannier Market ; borough engineer.

Blackpool.—Extensions and alterations to N.F.S. Sub-divisional Station, Bispham ; borough surveyor, Municipal Buildings, Town Hall Street.

Boiler house, 210, Watson Road; Fluxio Tool Co.

Bradford.—Nursery, Toller Lane ; city architect.

Additions, Children's Homes; city architect.

Bromsgrove.—Works extensions; J. Ackworthie, Ltd., 54, Coleshill Street, Birmingham.

Cardiff.—School canteens (£3,795) and improvements, High School, Howard Gardens (£2,650); city engineer.

Caterham.—Restaurant, Coulsdon Road (£2,717); U.D.C. surveyor.

Chester-le-Street (Co. Durham).—Electric lighting in public shelters; A. T. Pallister, surveyor, R.D.C. Offices.

Cobham.—British Restaurant at village hall (£1,181), for Esher U.D.C.; surveyor, Council Offices, 1, High Street, Esher.

Coulsdon.—Two restaurants (£3,500); Falkus Bros., Ltd.

Dumbarton.—British Restaurants at Alexandria and Renton (£2,500 each), adaptations at Bellfield Remand Home, Dumbarton, and repairs to school property (£9,910); county architect, 18, Park Circus, Glasgow, C.3.

Easington (Co. Durham).—Further British Restaurants for Rural Council; C. W. Clarke, surveyor, R.D.C. Offices.

East Didsbury.—Church, Parrs Wood Road South; Rev. J. Bretherton, 13, Parsonage Road, Heaton Moor, Stockport.

Epsom and Ewell.—Further British Restaurants at West Ewell and Ewell (£2,650); Norman Auty, borough surveyor, Town Hall, The Parade, Epsom.

Hastings.—Boiler house, Saxon Road laundry, for Mr. F. Feaist; Ward, Son & Wray, architects.

Hereford.—Workshop at garage, Blue School Street; Brook Bros. (Hereford), Ltd., motor engineers.

Extensions to offices; Pye Bros. (Hereford), Ltd.

Hornchurch.—British Restaurant, Grenfell Avenue, for U.D.C.; D. E. Hart, surveyor, Council Offices, Billet Lane.

Ilkeston. — Canteen, Gladstone school ; borough engineer.

Jarrow (Co. Durham).—Conversion of St. Kilda Church into social service centre (£2,000); T. Fairless, Citizens' Advice Bureau, Jarrow.

Kettering.—Additions to bacon curing works, Stamford Road; W. B. Wright, The Warren, Windmill Avenue.

Leyland.—British Restaurant; R. W. Lynn, clerk, Council Offices, Leyland.

Lichfield.—Headquarters for the N.F.S.; borough surveyor, Guildhall, Bore Street.

Maghull.—School for Lancs Education Committee; John Turner & Sons (Preston), Ltd., builders, William Henry Street, Preston.

Maidenhead.—Additional British Restaurant; borough surveyor, Guildhall.

Manchester.—Office and store, 611, Stretford Road; Donald MacDonald, Ltd., building contractors, Trafford Bar.

Middleton.—Conversion of Hopwood Hall into offices; Lancashire Cotton Association, Ltd., Blackfriars House, Manchester, 3.

Morpeth (Northumberland).—British Restaurant; F. Kirby, borough engineer, Corporation Offices.

Newbury.—British Restaurant, Northcroft; borough surveyor, Municipal Offices.

Newcastle-on-Tyne.—Offices, Shields Road, for C. A. Parsons & Co., Ltd.; own architects.
Furniture warehouse for Hoult & Son; T. Clements & Sons, Selborne Gardens, Newcastle.
Dye store, for Angus & Co., Ltd.; Hetherington & Wilson, architects, County Chambers, Westgate Road.
Canteen and pattern store, for Donkin & Co.; own architects.

Oxford.—Additions to canteen, for City Motors, Ltd.; Wooldridge & Simpson, builders, Frenchay Road.

Plymouth.—Extensions at Lee Mill Hospital, and repair of maternity block at General Hospital, Greenbank; J. Paton Watson, city engineer, Guildhall.

Ripley.—Memorial Hall (£4,500); Rev. H. P. Hargreaves, The Vicarage, Ripley, Derby.

Rochester.—Prefabricated canteen buildings at Delce Farm and at the Casino, Corporation Street; town clerk, Guildhall.

Royton.—School clinic and child welfare centre for Lancashire Education Committee; A. Evans, county architect, County Office, Preston.

Scarborough.—Alterations for Swift & Sons; F. Baker, architect, York Place.

Sheffield.—Partial completion of extensions to Jessop Hospital for Women, and provision of 20 nurseries, various sites; W. G. Davies, city architect, Town Hall.

Shilbottle (Northumberland).—Miners' canteen; R. Carse & Sons, High Street, Amble.

Shildon (Co. Durham).—Children's nursery; A. Metcalfe & Son, Dent Street, Shildon.

Sleekburn (Northumberland).—Miners' canteen; Brown, Son & Harding, Pearl Buildings.

Southall.—Dairy and pasteurising depot, Havelock Road; Norwood Farm Dairies, Ltd.
Laundry extension, Regina Road; Scotch Thistle Laundry.
Café (£1,200); borough engineer.

Southwell.—British Restaurant at Edwinstowe, for R.D.C.; John Ellis, clerk, 8, Westgate, Southwell, Notts.

Stalybridge. — Bakehouse, 15, Grosvenor Street; Miss A. Hinchliffe.

Stoke-on-Trent.—Erection of huts for use as British Restaurant; A. Burton, city engineer, Town Hall.

Stretford.—Electric lighting and heating of 15 shelters; E. Parker, borough engineer, Town Hall, Talbot Road.
Offices and store, Ashburton Road; Massey-Harris, Ltd.

Walsall.—Mess room and kitchen, Goodall Street; borough engineer.

Weardale (Co. Durham).—British Restaurant, Stanhope; J. R. Ridley, R.D.C. surveyor.

West Hartlepool.—Three cooking depots for providing meals for schools; Education Committee.

Wigan.—Cooling room for dairy; Wigan Dairies, Ltd., Moore Street.

Witney.—British Restaurant at Old Church hall, Burford, for R.D.C.; surveyor, 103, High Street.

Wolverhampton.—Canteen extension, Transport depot (£500); borough engineer.

Workington.—Air-raid shelters and extensions to salvage department for T.C.; R. W. Copeland, builder, 25, Guard Street, Workington.
Slaughterhouse on Northside for T.C.; A. B. Cooper, borough engineer, Town Hall.

York.—Restoration of the Church of St. Martin-le-Grand, Coney Street; Rev. Canon C. C. Bell, 7, Minster Yard, York.

I.E.E. Meetings

IMMEDIATELY following the formal ordinary meeting of the Institution of Electrical Engineers on Thursday, July 9th, at 6 p.m. for the election and transfer of members, an additional meeting of the Installations Section will be held at which there will be an informal discussion on "Wartime Maintenance of Electrical Installations and Equipment."

The discussion will be opened by Mr. S. W. Field and advance copies of his remarks will be available about ten days before the meeting and can be obtained on application to the Secretary.

An additional ordinary meeting, which will be a joint meeting with the Institution of Mechanical Engineers, will be held on Thursday next, June 25th, when a paper on "The Soot Blower, with special reference to the present position of Power and Automatic Operation of Mechanical Blowers," by Mr. R. J. Glinn, will be read and discussed.

The annual report of the North-Eastern Centre shows that during the past year under the chairmanship of Mr. R. W. Gregory, thirteen meetings were held at which the attendance averaged 55. Of the four premiums awarded for papers read to local members, three were secured by students. The Centre membership increased by eleven to 775, including the Tees-side Sub-Centre membership of 139, or 17.9 per cent. of the total, and the local Students' Section total of 283, or 36.5 per cent. of the whole. The new chairman for the 1942-43 session is Mr. H. W. Green.

The average attendance at the seven meetings held at the Tees-side Sub-Centre increased to 28. The new chairman is Mr. H. Shaw.

The local Students' Section held eleven meetings, at which the attendance averaged 27, as well as two or three works visits and social functions.